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EXPLORATIONS IN DUTCH NEW GUINEA.*

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THREE years ago, in order to commemorate their jubilee, the British Ornithologists' Union, at the suggestion of Mr. W. R. Ogilvie-Grant, decided to despatch an expedition to New Guinea, the largest unknown area of land in the world outside the Antarctic, for the purpose of forming a collection of fauna and flora of that island, the results to be presented to the British Museum. In order to obtain as interesting a collection as possible, it was decided that the unexplored south-western districts in the close neighbourhood of the great central Snow range should be the immediate goal. To carry this project into effect, a strong committee, including Mr. F. D. Godman, F.R.S., President of the British Ornithologists' Union, who was appointed chairman, Mr. P. L. Sclater, F.R.S., editor of the *Ibis*, and Mr. E. G. B. Meade-Waldo, with Mr. W. R. Ogilvie-Grant as secretary, and Mr. C. E. Fagan treasurer, was formed and funds collected. Mr. W. Goodfellow, a well-known ornithologist, was appointed leader, with Mr. A. F. R. Wollaston as medical officer, entomologist, and botanist, positions he had already filled with much distinction in the late Ruwenzori expedition; and Messrs. G. C. Shortridge and W. Stalker, both well known in the East, as collectors.

But, like many previous expeditions which have left this country, the staff and the intentions gradually increased. The Royal Geographical Society, ever ready to assist where new geographical problems were to be solved, joined hands, and liberally contributed to the funds. I was appointed surveyor, and Mr. E. Marshall, medical officer to the late Antarctic expedition and one of Sir E. Shackleton's companions on the final advance to the south pole, joined as surgeon and assistant surveyor.

Through the Dutch Minister for the Colonies, and with the kind

* Royal Geographical Society, July 3, 1911. Map, p. 344.

assistance of Sir Edward Grey, permission was obtained for the expedition to land on the south coast of Dutch New Guinea on any date after January 1, 1910. In addition, the Netherlands Government supplied an armed guard, offered a ship of the Dutch Indian Marine for the transport of the expedition to New Guinea, and agreed to keep up communication by a two-monthly service between Amboina and the place of disembarkation.

The personnel of the expedition left England on October 20, 1909, picked up ten ex-military police Gurkhas at Singapore, and landed at Batavia December 1, 1909. Here a delay of three weeks took place while the *Nias*, a Government Marine ship of 850 tons, was being got ready for the transport of all our stores, the forty Javanese soldiers and sixty convicts, the latter to act as carriers for the soldiers, and the building material, stores, equipment, etc., for the escort. Lieut.-General G. C. van Daalen most kindly lent the services of Lieut. H. A. Cramer to command the escort, and assisted the expedition in every possible way to complete its arrangements.

From inquiries made before leaving England, it was decided that the Utakwa, the mouth of which river was known to lie due south of Carstensz peak, the greatest of the snow-peaks, should be utilized as our line of communication. Prior to our advent but two rivers on the whole of the south-western coast of New Guinea had been visited, the Utakwa and the Mimika, and these had only been explored for a few miles from their mouths. Further inquiries made in Batavia induced Mr. Goodfellow to change his objective from the Utakwa to the Mimika, and this, little as we suspected it at the time, sealed our fate as to all possibility of ever reaching the Snows.

On December 22 we left Batavia, and reached Dobo in the Aru islands, the headquarters of the Australian pearling fleet, on January 2, having picked up Stalker at Amboina, to which place he had proceeded for the purpose of collecting one hundred coolies to act as carriers.

On January 3, 1910, we left Dobo and civilization behind, and by daybreak on the following day obtained our first view of the land we had determined to explore. We were rapidly approaching a great bluff, the south end of the Charles Louis range. Changing course eastwards, the whole range of snow-capped mountains was unfolded to our view as the morning mists dispersed. Stretching in one unbroken line, from the Charles Louis range on the west to the Orange range on the east, lay what was then known as the Snowy range, but which her Majesty the Queen of the Netherlands has been graciously pleased to allow me to name the Nassau range. Rising to its greatest height in the east at Carstensz peak, seen by a Dutch captain of that name in 1623, it runs nearly level for 60 miles to the west, the snows giving place to a mighty precipice, and then gradually falling away to the dividing valley before the Charles Louis range is met with. In front and barring our approach lay range

upon range of knife-edged ridges and forest-clad mountains, broken into sections where cut by the rivers flowing from the north. For 50 miles from the coast lies a dense forest-covered swamp, in no spot rising more than a few feet above sea-level, and at the moment when first seen enveloped in a dull grey water-laden mist.

Great difficulty was found by Commander Houdius van Herwerden in locating the mouth of the Mimika, for on account of the shallowness of the sea it was impossible to steer close into the land, and the mouth of one river is exactly like another. Even when a few miles distant it was evident that our arrival was causing intense excitement on shore, for signal beacons were lit from end to end, the thin columns of smoke rising high above the trees. From every inlet and river, canoes, laden with naked Papuans, shot out, attempting to intercept the ship and following us down the coast. Splendid creatures they looked as they stood up in their canoes and raced along with mighty sweeps of their paddles, endeavouring to keep pace with the steamer. Failing to find the mouth of the Mimika, we anchored before an open bay, and lowering the launch approached close to the shore, the native canoes now keeping at a distance. No opening being found, we hailed a canoe which was flying some bunting, and great was our surprise to find this was a pilot's Union Jack. This was immediately pulled down, stowed away, and never again seen by us, but where it came from and how obtained by these people remains a mystery to this day. No fear was shown by the occupants of the canoe; the chief, a man of perfect physique, stepping into the launch and shaking hands with all on board. The hand-shake was given by grasping the fingers firmly and then pulling the hand sharply away. The word Mimika was sufficient for our guide to direct us to a clump of casuarina trees far down the coast. He returned with us to the ship, and coming aboard made himself quite at home. This was the signal for the other canoes to range alongside, and for the occupants to scramble aboard likewise, until fifty or sixty must have been collected.

Weighing anchor, we were before the mouth of the Mimika by dusk. The captain now gave orders to clear the ship, but here he reckoned without his guests, for it was found that every canoe had vanished but two; these were packed to the gunwales and driven off, the remainder of the men having to stay on board for the night, as it was impossible to make them swim to the shore, the sea swarming with sharks. Darkness coming on, and unaccustomed to late nights, the natives soon turned in, and, oblivious of the noise and electric light, lay close together on the bare deck, packed like sardines, each man's chest against his neighbour's back, and the heads resting on the brass-bound steps or other support, however uncomfortable.

The following morning Goodfellow, Cramer, and I, set out in the launch to explore the Mimika river. The ship was lying 3 miles out to sea in 4 fathoms of water. Crossing the bar, we entered a fine stretch of water

1500 yards in width, with sandy spits on either side, on which were situated the villages of Atabo and Taroké, all the inhabitants turning out to gaze at the new-comers as they passed. On steaming up easy reaches of river, the banks were seen to be covered with mangrove trees, the roots of which, growing from mud and slime and covered with water at every tide, rendered cross-country progress an impossibility. At the third mile a great river entered from the west; the Mimika itself, upon which was situated Wakatimi, the village we were in search of, supplying but one-third of the volume of water; it was at once evident that our river came from the jungle and not from the hills. Captain de Jong and Herr Dumas, who had explored the Mimika as far as Wakatimi a few years previously, have most unaccountably omitted to make any reference to this river—the Watuka—of which the Mimika is but a tributary.

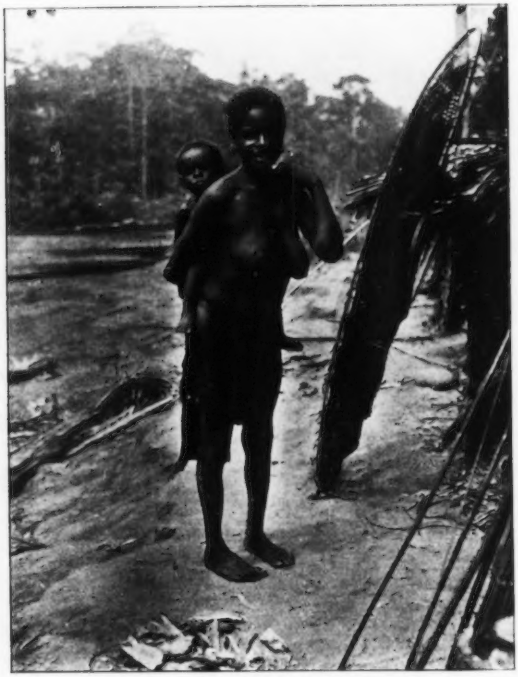
Entering the Mimika proper, we were met by great numbers of canoes, the paddlers waiting to give us a welcome, shouting their loudest and throwing themselves out of their canoes backwards into the water. Reinforced every few hundred yards by other canoes, there was soon a large flotilla paddling hard in our wake. One and a half miles further on we entered an open stretch of water, on the right bank of which was situated Wakatimi village. Crowds of women and children added their shouts to those of the men, throwing themselves into the water, smearing themselves from head to foot in filthy mud, plastering it over their faces and into their hair. In this horrid state and naked, except for a narrow strip of bark cloth, they then proceeded to dance, every now and again going on their hands and feet and waving their sterns from side to side, their heads being away from us. We were soon on shore, this being a signal for the women and children to vanish. Wakatimi, consisting of a long row of about 150 huts built of pandanus and palm-leaves, with a row of cocoanut trees in front, was soon explored, for we were on the look-out for a camping-ground, but here not an unoccupied inch was available. On the opposite side of the river, however, where it took a sharp bend, some ground with thinner forest was observed, and on this Goodfellow decided the base camp should be pitched. Lieut. Cramer therefore landed some soldiers, and clearing a space camped for the night, Goodfellow and I returning to the ship.

The next three days were occupied with the disembarkation of men and stores, the cleared ground was extended, the cutters much hampered by the crowds of natives collecting from all quarters. Cramer early erected a paling around the camp, but over and over again was this pushed to the ground by the press of men, gazing open-eyed at the, to them, weird creatures who had so unexpectedly entered their country. There were no signs of hostility, only curiosity, and while those of our party on the ship were catching and landing ground-sharks, those on shore had time to examine the natives amongst whom they were thrown.

Almost coal-black in colour, and rather exceeding the average European

A PAPUAN OF THE MIMIKA DISTRICT.

A NATIVE OF THE UP-RIVER MIMIKA.



MOTHER AND CHILD OF PARIMAU VILLAGE.

WAMBIRIMI, A VILLAGE OF THE TAPIRO TRIBE OF PYGMIES.

in height, the Mimika coast native, with his splendidly developed muscles, is physically an almost perfect man. But the brutal features of his face, accentuated by the closely cropped head, make him anything but an attractive creature. The mass of fuzzy curly hair, in which the natives of other districts take so much pride, is here cut off by means of sharpened shells, split bamboo, or an old piece of hoop iron. What remains is closely plaited in ridges. With the loss of hair nearly all love of decoration or ornament seems to have vanished, their dress consisting of a large white shell worn on the stomach, a hollow carved bamboo, or a narrow strip of tree bark beaten soft and pliable. Round the neck a few beads may be strung, while below the knee and around the biceps a narrow band of plaited grass may often be seen. As a further attempt at ornament, a few white feathers of the hornbill may be stuck into the hair, or if a fierce expression is desired, the split beak of the same bird is pushed through a hole in the septum nasi. The women are even less given to trinkets, for, besides the narrow strip of bark hanging down in front and behind, they are as bare as nature made them; poor creatures, they have little time to think of anything but work. Widows are rather favoured in this respect, for their weeds consist of a great poke bonnet, in addition to a bodice and skirt, all of grass. The instinct of self-adornment is, however, very strong, for trade articles, such as beads and cloth, were subsequently not only eagerly sought for but worn on all important occasions. Slaves from childhood, worked from daybreak till long after dark in the search for food, and to make the man, their master, happy, they rapidly become old, haggard, and hideous. Boys at an early age free themselves from any maternal restraint, simply regarding their mothers as the food providers. Girls, on the other hand, cling closely to the maternal home, and from babyhood join in the work in the sago swamps, or in the search for fish and crabs. Even to our unpractised eyes it was easy to distinguish the various tribes, for those coming from the east were not only of a more brutal type, but in many cases dispensed with any form of clothing. Absolute nakedness was rare amongst the Wakatimi people, for girls wore some form of dress from an early age, and boys took on the garb of manhood at the age of fifteen or sixteen.

The front teeth of the men, but not the women, are in many instances sharpened to a point, a painful process, for the operation is carried out, not by filing, but by chipping the sides away with a piece of iron, or, if this is not available, a hard shell used after the manner of a chisel. This custom of sharpening the teeth is often put down as a sign of cannibalistic practices, but we have no reason to believe that the habit of eating human flesh is ever here put into practice. Certainly during our sojourn amongst these tribes we saw no signs of cannibalism, nor when examining the human bones preserved in every house, did we find any evidence pointing to such a custom. When questioned on this subject, some natives showed abhorrence, whilst others exhibited at any rate no great disgust at the

suggestion. Circumcision is not practised in these regions. Syphilis is common and characteristic. The natives suffer from malaria, but, as far as we know, not from beri-beri. Wollaston noticed two or three doubtful cases of leprosy, but never a case of tubercle. The tropic ringworm Cascado is extremely common, often spreading over the entire body.

Wakatimi, as we afterwards found, was but a sample of other coast villages, consisting of a long row of huts made of pandanus and palm leaves held up by poles cut from the forest. Each new-comer adds on his hut to the last, at the same time removing the partition, by this means turning the village into one endless habitation, broken by their respective doorways. The floors were of sand brought from the seashore, and, with the exception of the crudest of fireplaces, other furniture there was none. Skulls and the bones of departed relatives dangled in grass bags from the roof, blackened by the smoke of the fires. Now and again a wood pillow might be seen, otherwise the interior was bare. Outside there stood, ready for instant use, a stone club, a few spears—the heads fashioned from the leg-bones of pig or human beings—or a bow and a sheaf of arrows, to which weapons they flew on the slightest provocation. A peaceful village one minute, the next a scene of turmoil, spears whizzing through the air, clubs being wielded indiscriminately and in earnest, whilst the air resounds with the wild yells of man and woman alike. These were the nightly broils which welcomed us to these shores, for the joy of our arrival induced the men to break out into wild orgies of drunkenness. Daily parties of topers settled round the sugar palms and drank their fill of the potent beer, returning at night full of cheer, and winding up the carouse by wife beating, house burning, or some such attractive amusement.

Immediately the men and goods were disembarked, the *Nias* returned to Dobo for the one hundred coolies who had been collected at Amboina. They were an even more disappointing lot than we had been led to believe, and fifty were at once rejected by Wollaston as worthless. The remainder were of most indifferent quality, but had to be retained, for it was soon evident that we could in no way rely upon the local native for river work. He was willing enough to trade, but, except for supplying roofing for the houses, could not be induced to do any manual labour. Fortunately for us, the Wakatimi people were only too anxious to sell canoes, for we had no water transport whatever. These canoes were at first purchased for a handkerchief or a small knife, but as time went on and our demands increased, the price slowly rose till the sum of two axes was reached, and even this was hardly sufficient to seal the bargain.

The style of canoe which finds most favour in these parts has a length of between 50 and 60 feet, taken from one tree-trunk and hollowed out by stone axes, fire, or, on rare occasions, by an old piece of iron which had been traded down the coast. An idea of the labour entailed in their construction may be judged from the fact that suitable trees are scarce and are rarely to be found close to a river-bank. The tree has first of all to

be felled, then a clearing in the forest made along which the great log may be dragged, a feat which requires the accumulated strength of the whole village. From the launching place it is floated to the village, where the hollowing out, finishing, and decorating takes place, after which it is burnt to prevent the intrusions of the water-insects; the whole process often taking many weeks and even months.

As rain fell daily, and for want of cover much rice and food-stuffs were being spoilt, particularly the dried fish and meat, houses had to be hastily erected. We were saved the tedious and difficult task of making roofing, for the natives were only too keen to supply any amount of attap, a form of tiling with plaited pandanus leaves, an excellent provision for keeping out the rain, and one which lasted well for seven or eight months.

On January 9 the first disaster overtook the expedition. On that afternoon, Mr. W. Stalker, a collector well known throughout the East, who had joined us at Amboina, to which place he had proceeded to make arrangements for transport, entered the forest for the purpose of collecting a few birds. At four o'clock the rain commenced to fall in torrents, as it invariably does at this time of year. His absence was not noticed till dark, by which time it was impossible to send out search parties; the night was as black as ink, and, with the rain lashing down, all search in the dense forest was rendered quite impracticable. We expected every moment to hear him return, but as the long hours of the night dragged by, hope gradually vanished. At dawn Cramer turned out the Javanese troops and despatched them in parties through the jungle, while the Gurkhas divided into parties, and, assisted by the natives, thoroughly searched the surrounding country. But all without result, not a sign or a trace of Stalker's movements could be found. The search was continued on the following morn, but not till the third day did we learn the fate which had overcome our comrade. His body was found by natives floating in a creek not half a mile from the camp. He had without doubt lost his way, and when night fell, instead of attempting to settle down till daylight came, had tried to force his way through the undergrowth, and had fallen into a creek. He was buried close to the camp beneath the one tree still left standing.

I cannot but impress upon future travellers in this land the necessity, if lost in the forest, of not trying to fight a way out, but before darkness falls, of finding a spot on which to spend the night, erecting some kind of shelter of leaves, and, if the matches are not sodden, lighting a fire. Search parties will be certain to bring help in the morning. On many occasions men were lost on this expedition, but never for a longer period than two nights, and that only happened twice. The phlegmatic temperament of the natives of the East enables them to pass through such an incident almost with indifference; but to the highly strung European the strain on the mind is one which leaves its mark. Just before leaving the country a Dutch sergeant was benighted at Wakatimi, and, though the night was clear and fine, and food and matches were in his possession,

he was in a complete state of collapse when found by the Gurkhas the following morning, and talked nonsense for the next three days.

An attempt to explore the river failed, for the natives refused to proceed beyond 10 miles, and our own coolies, unused to river work, were quite incapable of manœuvring the long narrow canoes. A second attempt proved more successful, for although half the natives deserted on the third day out and the remainder on the fourth, our own men from necessity were forced to learn the work. From the variety of obstacles which encumbered its bed, no river can offer such a change of exercise as the Mimika. One day a swollen torrent, the next a series of pools divided by banks of soft mud, stony runs or tangled masses of tree-trunks, and over, round, or through these obstructions the heavy-laden canoes had to be hauled. When in flood no bottom could be found with the poles; when empty there was insufficient water to float the canoes. On either hand grew the densest of vegetation. Mighty trees with gnarled and twisted roots fought for existence with thousands of younger growth, the whole held together by a tangled mass of rattan and other forms of creepers. Besides those already mentioned, the following were the most common: Artocarpus, Eriodendron, Ficus, and sago; and of the creepers are three or four species of rattan, the scarlet-flowering creeper *Mucuna pruriens* and the wild *Vanilla planifolia*.

Parimau, a village of twenty-five huts situated at the furthest navigable point, was reached on the seventh day out, and here the forward camp was pitched. During the last two days we had been assisted by what were afterwards known to us as the up-river natives, men similar in build but of more pleasant appearance and superior intellect to the coast tribes. The welcome accorded us was a painful one, every man howling as if in the utmost grief, the tears coursing down his cheeks, and sweat pouring down his body. This, as we afterwards learnt, was a form of welcome, or perhaps it might be more accurately described as a prayer, for it was practised on one occasion in the presence of Marshall and me when crossing a swollen and rather dangerous river.

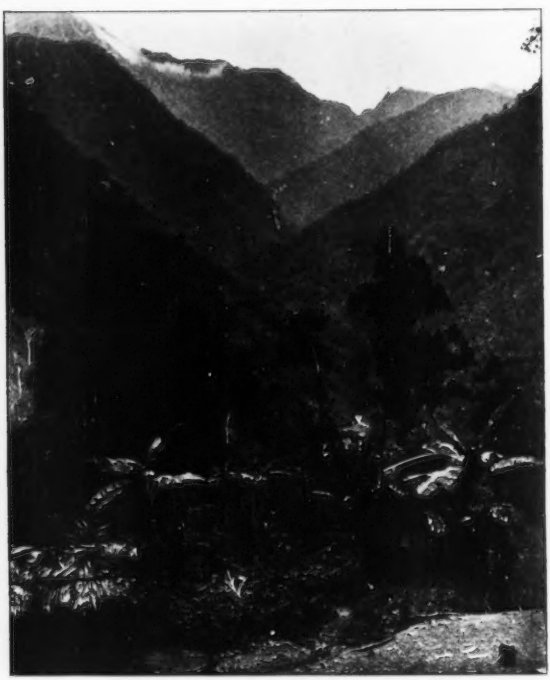
Parties of natives arrived daily from the east, hastening to the one point where they might inspect the new-comers, the Parimau people showing us off as their own personal property. After much explanation—for the language proved an extremely difficult one to grasp—the natives agreed to show us the way to the hills. Accompanied by a Dutch sergeant and two Gurkhas, I reached the Kaparé river at a point north-north-west of Parimau and 7 miles from the mountains; but on account of the refusal of the carriers to go further, and a panic which overtook them during the night, I was forced to return on the third day. The size of the river, here some 200 yards in width, with great forest-clad mountains close at hand and a mighty precipice beyond, encouraged the idea that this route might be of use for a forward advance, particularly as the natives declared that no other road existed. It was therefore decided that I should prepare and

VIEW EAST FROM THE CLEARING AT PARIMAU (100 FEET ABOVE SEA-LEVEL).

THE WATAIKWA RIVER FROM ABOVE THE MAIN CAMP.

"BOY SCOUTS." PARIMAU CHILDREN WITH THEIR FATHERS' CLUBS, SPEARS, ETC.

BRIDGE BUILT BY THE EXPEDITION ACROSS THE IWAKU.



TAPIRO PEAK, 7500 FEET; FROM WAMBIRIMI VILLAGE, 1800 FEET.

clear this route while Goodfellow returned to Wakatimi and despatched a party up the Watuka, which we concluded must be the same river. Unfortunately, on reaching Wakatimi Goodfellow discovered that the whole of the coolies had departed, their contract time of six weeks having expired simultaneously with the arrival of a relief ship. On March 3 he left the country to recruit a fresh lot of men in the islands of Amboina and Boeton, and with him sailed the remainder of the men who had been at Parimau. We were now compelled to rely entirely upon what assistance we could obtain from the natives. Shortridge remained at Parimau, while Cramer, Wollaston, and Marshall, with a scratch crew of Papuans, soldiers, and convicts, explored the Watuka, otherwise the Kaparé. Obota, a village of two hundred huts situated partly on an island and partly on the right bank of the river, and surrounded by tobacco and banana plantations, was reached on the first day. Rapids were found above the village, but these were successfully evaded by a jungle creek. A great volume of water was passing down the river, here of great width with open stony spits at every bend. The greater mass of water was found to escape by the Periepia mouth, across which a temporary dam of trees had formed. More rapids were found on the fourth day out, the party on the sixth day being forced to return on account of the speed of the current and the shallowness of the water. In the mean time I had passed across from Parimau to the Kaparé, there preparing a road, building a store-hut, and awaiting the arrival of the exploring party, who had been forced to turn back when within 4 miles of my camp. I had only succeeded in pushing my camp another 4 miles forward, for beyond this the natives refused to proceed. Rain fell daily in the afternoon, flooding the camp and the river. The greatest fall registered was 4½ inches, the least 1 inch, with an average of 2¾ inches. The Papuans who were with me had succeeded in capturing, after an exciting chase, two small men of another race, easily distinguishable by their small size, sturdy build, and difference of dress. Two days later two more were surrounded and caught whilst making an attempt to ford the river. They proved to be from a tribe known to the plainsmen as the Tapiro, living in the hills, and whose clearing in the forest, at an altitude of 1800 feet, could be seen from where we were encamped. Attempts to locate the place failed, for only the faintest of tracks were found, and neither plainsmen nor hillmen would render any assistance. Food now gave out, both at Parimau and with us on the Kaparé, both parties being compelled to subsist almost entirely on hornbills. The lowlands of this portion of New Guinea are singularly poor in food supplies, the natives subsisting mainly upon sago and fish, with an occasional pig and wallaby.

Wollaston joined me during the first week of March. Fresh attempts were made to reach the mountain clearing, and at last our efforts were crowned with success. No active hostility was shown, but it was very evident the pygmies did not desire our company. The ground cleared and cultivated had an area of about 120 acres, upon which grew taro and sweet

potato, and was situated upon the gentler slope of the mountain spur. Great tree-trunks lay in all directions, some levelled by fire while others showed evident signs of having been felled with the axe. The latter weapon, of which they had one or two, consisted of a small piece of soft steel, 4 inches long by 1½ broad, fitted into a bamboo root. The labour entailed in this work must have been immense, small portions of land being cleared year by year. Of their habitations we could find no signs.

Our journeyings through the forest and our climbs on this mountain had clearly demonstrated to us the impossibility and the uselessness of attempting an advance in this direction, and it was decided that the next move should be to the east of Parimau. Wollaston now returned to Wakatimi, while Marshall joined me, and together we reached the Tuaba river one day's march to the east. From this camp we first pushed up the river, obtaining a fair view of the mountains and correcting our position with reference to the snows. The Tuaba, a river equal in volume to the Kaparé, runs direct from the highest mountains to the north, and breaking into many streams as it reaches the plains, reunites 5 miles above the village of Ibo. At Ibo the Kamura enters from the north-east, the two together forming a river navigable, except at the very driest season, to any launch of 5-feet draught. The village of Ibo, consisting of about forty huts, was in every respect similar to Parimau, and here I may mention that the natives of this portion of New Guinea are divided into three classes or tribes. Firstly come the people inhabiting the low-lying ground near the coast and extending inland for about 12 miles, and known to us as the coast natives. Then comes a strip of land practically uninhabited, and above this again, on a level with the headwaters of the Mimika, a race known to us as the up-river natives. Still further north, and inhabiting the foothills, are the pygmies. These three tribes are entirely distinct from one another, having no communication in the north and south direction—even though living on the same river—but passing freely to the east and west. The dividing line is hard and fast, and is not crossed except for occasional purposes of trade.

It is impossible, in the small space at my disposal, to give a detailed account of the passings backwards and forwards, of the endless attempts to penetrate far into the mountains, the desertions by the natives, of the road cuttings, and of the many exciting incidents which befell the expedition. Of the weather alone I could write pages, for it not only hampered the advance, but prevented any astronomical observations being taken from January to the end of March, and again from the beginning of June to the middle of October, for not on one single night were the stars visible. The jungle was a swamp, the path rapidly becoming a bog, in which lay a network of roots and creepers, and through this the carriers moved everlastingly backwards and forwards. Every river-bed was filled to overflowing—a very serious matter for us, as our line lay east and west, and the rivers flowed north and south. Every march included at least one great river,

sometimes fordable and sometimes impassable, not counting the endless small streams between, each of which meant a wetting breast-high. In the forest leeches and mosquitoes abounded, but fortunately the latter were rarely *anopheles*, and in the camp swarms of bluebottles, whose one desire was to lay their eggs in any food or woollen garment, the young hatching out during the night.

So great were the floods of 1910 (I am inclined to believe an exceptionally wet year, for much ancient forest land disappeared) that the native village of Parimau was on three successive occasions washed out of existence, not one stick remaining, while the water rose over the floor of our huts 15 feet above the ordinary level. For three days in June was the Wakatimi camp under water, the highest point showing a depth of 2 feet, while the hospital and outbuildings were unapproachable. Under these conditions, as might be expected, a very large proportion of the escort and our men fell ill. The list of casualties from death and sickness is indeed an appalling one. During the first year 12 per cent. of the total force died, while 83 per cent. were invalided out of the country. The principal causes of sickness were beri-beri, malaria and dysentery, and to a less extent ulcers and sores, the latter mostly caused by thorns and leeches in the jungle. Of three hundred men employed during the first twelve months only eleven lasted out the expedition, and of these four were Europeans.

Nevertheless, work continued to progress steadily, Marshall succeeding in cutting a path through to the Puria, and from thence to the Wataikwa river, reducing the number of days' journey required from five to three. Wollaston, in addition to doctoring the sick, had the monotonous work of organizing and despatching the transport at Wakatimi, for when the new batch of coolies, recruited by Goodfellow mainly from the island of Boeton, arrived, they had to be employed for many weeks on the Mimika. A steam launch lent by the Dutch Government proved of too weak power to work against the current, and had to be discarded. All natives who were willing to work were employed in supplying the camp on the Wataikwa with food, and in clearing a large area of forest land at Parimau. This clearing, 14 acres in extent, took six months to complete; but it was worth the task, for it added to the health of the camp, and exposed to view the whole of the Snows lying to the east. With the latitudes of Atabo at the coast and Parimau known, and the azimuth obtained, it was easy to fix all the points in the range from Carstensz in the east to Mount Leonard Darwin in the west. The height of Carstensz, formerly assumed to be about 18,000 feet, was found to have an altitude of nearly 16,000 feet, while to the west three more great snow-peaks were discovered, with a height of about 15,400 feet; these we named Mount Idenburg, after the present Governor-General of the Netherlands India, as a slight token of gratitude for the assistance rendered to the expedition by the Dutch authorities. Beyond and between these two mountains two other great snow-peaks were visible, evidence

that the ground to the north does not fall abruptly away. But more interesting than all was the discovery that the great range, stretching from Carstensz in the east to the Charles Louis mountains in the west, a distance of 80 miles, formed one immense unbroken precipice, culminating in its greatest sheer height at Mount Leonard Darwin (named after the late President of the Royal Geographical Society). We were never in a position to measure with the theodolite a greater sheer height of more than 6500 feet, but from many views obtained while climbing, I have no hesitation in stating that the greatest perpendicular height is, at this spot, not less than 10,500 feet, or 2 miles. To the west of Mount Darwin the range continues to diminish, the precipice dwindling in proportion. To the eye this wall of limestone rock, though split into many sections, appears quite impregnable, a perpendicular wall of dead black stone, relieved by splashes of white where the water catches the rays of the sun.

The strata rise at an angle of 25 degrees from the north towards the south. For a distance of 17 miles to the south of this precipice lie two noticeable ranges of hills, with an average altitude of 8000 feet, as if two great slices had broken away from the range behind, but cut by the great rivers flowing from the north, and worn into fantastic shapes by the course of ages. These lower ranges are covered to their summits with dense vegetation, the high range behind being bare and barren. The snow-line is at about 14,500 feet, the glaciers on Carstensz descending lower and falling over the precipice to the south. From a letter received from Lieut. Postema, the naval officer in charge of the survey of the Dutch Expedition on the Utakwa river, I understand that he also is of opinion that Carstensz mountain is not climbable. The extreme wetness of this district is, without doubt, due to the great altitude and proximity of these mountains, the rainfall being in excess of any other portion of New Guinea.

While stores were being slowly collected upon the Wataikwa, work was being carried on without a pause on the opposite side of the river, a path 5 miles in length being finally cut through to the Iwaka, a permanently unfordable river. Words fail me in attempting to describe the condition of the forest along this section of the road, for with three Gurkhas and five natives, the 5 miles took five weeks to accomplish, of which 5000 yards took three weeks. The trees, from 4 to 8 inches in diameter, were formed of the hardest wood, covered with earth and moss, and growing so close together that without cutting it was impossible to force a way through. When completed, so bad was the going that the path had to be abandoned, and a fresh one cut to the south and entirely in the plains.

To assist in the transport of the stores up the Mimika a motor-boat of 10 horse-power had been purchased in June, but this—from which so much was expected—was wrecked one night while returning down the swollen river. Sickness amongst the Dutch and our coolies continued

to increase, till by August but twelve of our carriers remained fit for work. Shortridge, who had been suffering much from malaria, and had been invalided to Australia for three months, returned in September, but was compelled to leave the country for good in the following December, the fever having in no wise abated. Goodfellow likewise had been suffering from fever since June, and in his weak state was attacked by beri-beri, necessitating his departure for England early in October, and from him, by order of the committee, I took over the command of the expedition. Progress had been at a standstill for some two months, for Mr. Claud Grant, who had arrived in the country to take the late Mr. W. Stalker's place, was collecting on the Kaparé at the foot of the Tapiro mountain, while Shortridge was on the Wataikwa at similar work, and the few coolies at our disposal were kept fully employed in supplying these two camps with food. With Goodfellow went the remaining eight coolies, and again we were left without a single carrier.

With the assistance of natives, Marshall and I, picking up Grant on the way, paid a visit to the pygmy village of Wambirimi, or Wambirimerbiri, situated on a knoll to the south of the clearing we had visited nine months previously, and camped there for two nights. Some forty to forty-five men appeared, but despite the heaviest bribes offered for the sight of one woman, none of the latter put in an appearance, their fires at night showing them encamped high up the mountain-side. No woman was ever seen by us, the men refusing to exhibit their wives, even though

	Tapiro tribe of pygmies.	Parimau men.	Coast tribes.	European.
Skin colour ...	Brown	Dark brown	Very dark brown	—
Hair colour ...	Black	Black	Black	—
Hair on face ...	Plentiful	Scanty	Moderate	—
,, body ...	Scanty	,,	Plentiful	—
Height of stature	144·6 cms.	166·4 cms.	166·14 cms.	167
Girth of chest ...	79 ,,	90 ,,	92·1 ,,	86·7
Vertex of tragus ...	12·3 ,,	13·32 ,,	13·3 ,,	13·8
Head length ...	17·71 ,,	18·72 ,,	18·73 ,,	19·5
Head breadth ...	14·21 ,,	14·4 ,,	13·7 ,,	15·5
Face breadth ...	13·12 ,,	13·44 ,,	13·6 ,,	—
Bigonial breadth	11·38 ,,	12·27 ,,	11·83 ,,	—
Face length ...	11·07 ,,	11·88 ,,	11·8 ,,	—
Nose length ...	5·19 ,,	5·38 ,,	5·33 ,,	—
,, breadth ...	4·2 ,,	4·63 ,,	4·57 ,,	—
Interocular breadth	3·2 ,,	3·4 ,,	3·4 ,,	—
Nose	Straight, broad, flat	Straight, broad, flat	Straight, broad, flat	—
Nasal bridge ...	Nearly absent	Slight	Slight	—
Lips	Medium	Medium	Medium	—
Prognathism ...	Absent	Absent	Absent	—
Jaw angle ...	Marked	Marked	Marked	—
Chin	Square, also pointed	Pointed	Square	—
Shape of face ...	Short, oval	Long oval	Long oval	—
Prominence of cheek-bones	Medium	Medium	Medium	—

tempted with the unheard-of price of two axes a woman. The men showed no fear of the camera, possibly because they knew not what it was; but of the measuring standard and the craniometer many were terrified and could only be induced to submit with the heaviest of bribes. A comparison of measurements between the hillmen, up-river, coast natives, and the European I give above, each one showing the average of about thirty men chosen at random.

Prof. A. C. Haddon, one of the greatest authorities on anthropology, is inclined to believe that the plainsman and the pygmy are of the same aboriginal stock, and that the stronger members of the tribe, having seized those districts where food-supplies were more abundant, have developed proportionately; whilst the weaker, far from being degenerate as they have been termed, are the true representatives of the original race. In some respects the pygmy shows in intelligence an advance over his low-land neighbours; he builds his house on piles and for permanent use; and, more important still, has words to denote the numerals up to ten, while the plainsman has terms for the numbers of one and two only, any numeral above that being shown by the fingers and toes.

Space does not permit of giving more than a sketch of their homes and habitations. The men were naked except for bright yellow gourds 12 to 17 inches in length, 1½ inches in diameter, and tapering to a point. These were kept in position by a piece of string tied round the waist. Over one shoulder was suspended a large netted bag of string, in which were kept the fire-stick, split rattan, boar tushes, and other precious possessions. Around the neck hung a small bag holding tobacco and tinder. Many of the elders wore caps of cassowary feathers, cus-cus fur, or many pieces of string tied together in one knot. Necklaces were common, and made of rows of wallaby's teeth or the shoulder-blades of the same animal, or again of red and black beads. A few wore rattan twisted round the waist.

The houses, fourteen in number, were erected upon piles, the floor from 6 to 8 feet from the ground, and with an interior space of about 12 feet square. The roof was composed of palmetto leaves, the eaves projecting far over the sides. Entrance is effected by means of a rude ladder on to a narrow verandah, and from thence through an open doorway. The interior is encased in flat pieces of bark fixed to the walls and floor, and on this material the men sleep round the fireplace formed by a box of sand sunk a few inches below the level of the floor. In the village of Wambirimi are three artificially formed platforms, the soil having been levelled for this purpose. The live stock consists solely of a few yellow pie dogs of the usual kind met with in New Guinea. The pygmies proved to be the keenest of traders, and were willing to exchange everything they possessed, except their best arrows, for cloth or for a knife. When smoking, a popular habit amongst all these people, these men roll the tobacco in a leaf, and, closing one end with a finger and thumb, place the

PLAINSMEN AND PYGMIES FROM THE MIMIKA DISTRICT.

THE IWAKA RIVER AT LOW WATER, WITH A PORTION OF THE FOREST THROUGH WHICH THE EXPEDITION ADVANCED.

A PYGMY OF THE TAPIRO TRIBE.

TYPES OF TAPIRO PYGMIES.

centre of the cigarette in the mouth, drawing out the smoke through the crack formed by the folding leaf. On our departure their rough uncouth manners became very evident, for, having lost all fear of us, they fought for whatever we offered, the stronger taking the goods from out of the hands of the weaker.

Until the arrival of fresh coolies a further advance was out of the question, so to husband the advanced food-supplies, Marshall and I moved to the coast, there exploring the neighbouring rivers and creeks, and adding to our knowledge of the customs of the natives. During our year's sojourn amongst these people we had obtained considerable insight into many of their customs, though others remained a closed book. Marriage is of little importance and was only witnessed on one occasion, in this instance the men who had escorted the bride up the river betaking themselves to their homes, whilst the bride, preceded by an old woman, crawled through the mud and up the bank on her hands and knees, and in this degraded position reached and disappeared into her future home. Of birth we know nothing, but neither for marriage nor birth are there any festivities. At death the whole population breaks into a loud wail, men and women proceeding at once to the river and smearing themselves from head to foot in mud. The amount of wailing and howling is regulated by the importance of the deceased, and is carried on without intermission until the corpse is buried. The nearer relatives are led to the water by their friends and there washed. On two or three occasions the entire female population, removing every vestige of garment, would enter the water together, and, paddling like dogs, swim up the river, only to again roll in the mud, and, in this state of dirt and nudity, return to their homes. The corpse itself is treated after different methods. It may be buried and there left till the skeleton is clean, or it may be placed in an open grave hard by the village and turned over daily to hasten decomposition; or again it may be placed in a canoe-shaped box, roughly covered with a grass mat, and resting on trestles. The final result is the same in all cases, the skull when bare being preserved in the family hut and carried about from place to place, the larger bones of the body being likewise preserved or left to rot. Husbands and fathers, though attaching some value to these relics, are always ready to barter the skull of wife or child for a piece of cloth. During the early part of our visit, a few rudely carved figures of men—apparently gods—were to be seen lying about or propped up against a tree. Little respect was shown to these images, the men leaning against or patting them familiarly. When questioned as to what had become of the dead, we were told that they were "far away," this followed by a sweep of the hand to the horizon.

We were considerably surprised by the richness and variety of the singing and chanting, the entire audience joining in the chorus in addition to supplying a deep-toned hum maintained during the solo. An impromptu song is devised, and the vocalist, bedecked in plumes from the greater

bird of paradise, is accompanied by an orchestra of drums, the chorus terminating, with a touch of savagery, in a shout resembling the bark of a dog and given in unison. These concerts, given on all festive occasions, and sometimes on the night succeeding the death of an important individual, often last throughout the night, ceasing only at daybreak.

On December 23 the long-expected carriers arrived, but, to our great disappointment, they proved of even more inferior quality than the last batch. The fact is, now learnt from bitter experience, but according to what we had previously been told, the only men from the islands of the Dutch East Indies who are of the least value as carriers in New Guinea are the Dyaks of Borneo.

Notwithstanding the unpromising appearance of our transport carriers, it was decided to at once make an advance into the mountains, and by January 12 two and a half months' supplies had been collected at Parimau. From this place we had to proceed in two relays, Marshall and Grant advancing with the first party, pushing over to the Iwaka and two marches up the river, Wollaston, Cramer, and I following ten days later. The Iwaka, though not more than 40 yards in width, is both deep and rapid, and quite impassable either with a canoe or by fording. Like the Kaparé, Tuaba, and Wataikwa, its source lies at the foot of the great precipice to the north, but unlike those rivers its bed keeps to one channel, at the foot of the hills running through a perpendicular stratum of slate. Limestone, however, is the usual geological construction of this district, interspersed with clay and sandstone. Granite is only to be found as boulders in the river-bed. At the upper camp on the Iwaka coal is plentiful, but it is of a soft quality, and forms poor fuel. Of gold there was not a trace—iron, copper, and a small quantity of tin being the only minerals found. In the low foothills there were strong indications of oil, particularly noticeable in the vicinity of the coal.

Previous to this advance it was believed that the Iwaka flowed from the east, and along this we had settled to travel, making for the ring of hills to the north-east. To our great disappointment, on reaching the summit of the hill (3000 feet) lying due north of the camp, the Iwaka was found to run from the north and directly from the precipice, thus barring our progress to the east. In order to cross the river, Marshall and his men had made several attempts to fell trees so as to form a bridge, but without success, everything having been swept away in the flood. Fresh efforts were made, but with a like result. Only ten days' supplies of food had been accumulated, so that if we were to succeed in reaching the ring of hills to the north-east, it was imperative that a crossing should be made at once. The twenty coolies (the only men fit to work out of the forty-eight landed six weeks before) and the Gurkhas, fired with the desire to win a heavy money bribe, made many efforts to bridge or ford the river, but not till nightfall was there any success, when the Gurkhas felled a tree which, spanning the river, remained for a sufficient period to allow of

a passage and the securing of a thin rattan rope. The tree vanished in the night. The bridge, however, was completed in two days and the advance continued.

For a more detailed account of this part of the expedition and of the bravery of Jangbir the Gurkha, I must refer to *Country Life* of May 20, 1911. Sufficient to state here that the next river, a tributary of the Wania, was reached the same day. Owing to this delay, occasioned by the difficulty in crossing the Iwaka, our plans were again changed, and on the third day out, instead of continuing to advance along the new river-bed, we struck straight up the south-west end of the ring of hills, that night camping at an altitude of 3000 feet. The next march took us to the summit, 5250 feet, and here the camp was pitched. No view was obtainable, however, owing to the denseness of the jungle, and water was only to be found by squeezing the moss.

The going was of the worst possible description, no solid ground being found anywhere, the track lying entirely upon a tangled mass of living and dead timber; through and over this the passage had to be cut, the four best men taking that afternoon and the next day to clear a path for three-quarters of a mile. From where we were, 5800 feet, it was evident that a splendid view could be obtained in all directions, but the clouds hid everything. Only that day's rations remained; these were divided into two, and we decided to make a fresh attempt the next day. The result was all we had hoped for. Straight below us and to the south lay the dingy hideous plain stretching without one break from the Charles Louis mountains in the west to 50 miles beyond Carstensz in the east and right away to the sea. Great rivers, their waters shining in the morning light, twisted and turned in all directions, vanishing into and reappearing from the forest. All were visible—the Kaparé, Tuaba, Wataikwa, Iwaka, and Wania, every one of which we had been to, and the Aiika and Newerip to the east. The only one which was invisible was the Mimika, the river which we had selected for our main line of advance.

Directly to the east rose the Cocks' Comb, so called by reason of its three jagged and forest-clad peaks, completely hiding another mountain behind and the district drained by the Utakwa, on which river a Dutch Government expedition had been at work for a year.* To the north and north-east, and close at hand, lay the ring of mountains culminating in the summit (9000 feet) now named Mount Godman, after the president of the British Ornithologists' Union. Immediately to the west, and beyond this mountain towered the frowning precipice, from our present height looking more impregnable than ever. And to the west range upon range

* This Dutch expedition, under the command of Lieut. van der Bie, with Lieut. F. A. Postema, R.N., as surveyor, found the Utakwa navigable for a sea-going ship for 17 miles from the mouth. Beyond that point a launch could travel for two days and a canoe for one day more. The Utakwa was found to have its rise on Carstensz peak, but the mountain itself the expedition was unable to reach.

of wild tree-covered ridges, rising from the foot of the precipice, and gaining their greatest height at their southern extremities. From the edge of the foothills, which might almost be drawn in one straight line, so sudden and regular is the rise, stretches the waterlogged plain, nowhere over 150 feet above the level of the sea. As we gazed over the great expanse of country already covered by the expedition, and saw the forest-covered spurs and valleys which intervened between us and the Idenburg Snows, we fully realized the impossibility of accomplishing the feat of reaching the Snows with the Mimika as a base, however unlimited the time and funds, and however good the transport. Seven great rivers had to be crossed, any of which was capable of cutting the line of communication for weeks at a time, on five of which no boat could live, and only one, the Iwaka, which could be bridged. With the Wania, and possibly the Newerip, as the line of advance, to reach the precipice would be a difficult but by no means an impossible feat, but whether from there the cliffs could be scaled is another question.

Returning by double marches, for food was scarce, Parimau was reached on February 14, the men being set to pack up for the final return to the coast, whilst Marshall and Wollaston paid another visit to Wambirimi in the hope of seeing the pygmy women—again to be disappointed—I proceeding to the coast intent on further mapping. With the aid of the motor boat, which had been refloated and repaired by two Dutch military pioneers who had lately arrived in the country, I explored the Atoeka river to its junction with the main Kamura river, the eastern branch of which carries off an equal volume of water into the bay common to it and the Wania. Atuka village, consisting of about 600 huts with from 2000 to 2500 inhabitants, is situated on the right bank at the head of the tidal waters, and is surrounded by tobacco plantations and groves of cocoanut palms. The huts in their construction closely resembled those seen in all other villages, but, in addition the village boasted of two dancing-halls, 80 feet by 40, erected on piles.

Entering the Kamura proper, which, as will be seen by the map, takes the entire waters of the Tuaba, Wataikwa, and Iwaka, we proceeded to the Wataikwa junction, there camping for the night. From here to the north the courses of the rivers were known, as Cramer had visited the place three months before, and as the boat was making much water as a result of a violent collision with a sunken log, by which Bahadur, a Gurkha, was thrown overboard and nearly drowned, we decided to return to the coast, this time taking the eastern branch. Kamura village, consisting of about 250 huts and a population of 1000 to 1500, was passed at midday. No cultivation was seen, and the people were apparently of a much lower type than any previously encountered, many of the women and nearly all the men being entirely naked. A stay of only one hour was made at this place, for the people, though not exactly hostile, were bent on robbing the boat, an act which, if persisted in, must eventually have led to serious trouble.

Five miles beyond we suddenly entered the bay of Wania, into the north-eastern end of which the river of the same name flows. The bay itself, almost closed by a long narrow island, has a length of about 6 miles, and a width of from 2 to 3. Islands cover the surface of the water, and creeks enter from every side, while between the islands the waters of the two rivers pass through deep channels, many having a depth of over 18 feet. We camped at the mouth on a spit of sand, in front of which at low water was exposed a bank of black ooze, a favourite feeding-ground for endless varieties of fish of brilliant hue. Passing out by the western mouth of the bay, no indications of a bar were found, the pole failing to find bottom at 18 feet. I particularly mention this, for on revisiting this place two weeks later, a bank of sand at low water was found to stretch from the shore to the island, completely blocking all ingress except at high water.

On March 10 the whole expedition had assembled at Wakatimi preparatory to departure. Parimau had been handed over to the natives, who on Wollaston's and Marshall's departure had displayed much grief and sorrow curiously mixed with savage greed over the abandoned stores.

An attempt to explore the Wania river failed, the west mouth of the bay being blocked by a bar of sand, and the east mouth by a wild line of surf. Whilst running to the Mimika to shelter for the night from a fast-rising storm, the motor boat lost her propeller, compelling us to anchor at sea until the wind and sea abated, when with the assistance of the yawl we took her in tow, and after five days' strenuous work, berthed her inside our river. We had been on a lee shore, surrounded by foam-covered reefs, in a sea teeming with sharks, and only held by an old rope and light anchor. Had the boats swamped, or had anything given, it was certain death for the three of us, together with our seven men.

The whole coast is a most dangerous one, on account of the shallowness of the water and the speed with which storms arise. On several occasions relief ships arrived off the coast, and were forced to depart without landing their stores or being able to take away the invalids. None of the ships, each of which drew from 12 to 14 feet of water, could approach nearer than 2½ miles from the shore. This, together with the fact that every river has a pronounced and ever-moving bar, renders the south-east coast too dangerous for regular navigation.

On April 5, the gunboat *Mataram* and the marine ship *Zwaan* appeared off the coast, and by these ships we sailed for Amboina. Here the expedition broke up, Cramer and his men destined for Java, our coolies for Macassar, the Gurkhas for Darjiling, and we four for England.

I cannot close, however, without giving, in the name of the members of the expedition, our grateful thanks to the Netherlands Government and the Dutch authorities for the assistance rendered to the expedition, and the many individual kindnesses displayed. The Javanese soldiers had proved invaluable in guarding Wakatimi and Parimau during our long absences

in the mountains, and when encamped on the rivers to the east and west; and Lieut. Cramer, the leader of the escort, the only European who had remained with us from the beginning to the end, who had filled a difficult *rôle* with such ability, tact, and success. Of the Gurkhas I must specially mention Mahesur, Jangbir, and Harkajit.

To sum up the final results of the expedition: large and valuable collections of birds, mammals, reptiles, butterflies and moths had been formed, together with botanical and ethnographical specimens; a new and unknown race of pygmies discovered, studied, measured, and photographed; a range of mountains, containing the greatest precipice in the world, together with 3000 square miles of country, surveyed and mapped, new snow-mountains found, and many great rivers explored; and a long stretch of coast-line surveyed. We had accomplished the longest cross-country journey ever undertaken in Dutch New Guinea, *i.e.* eleven marches from the up-river camp, had proved the impossibility of the Mimika river as a line of advance to the Snows, and on the other hand the value of the great rivers to the east if the same goal is intended. From experience, and our heavy death-roll will bear me out, I have no hesitation in saying, firstly, that the land is an impossible one to any but a Papuan; and secondly, that, unless most carefully picked, no native of the East Indies, with the exception of Dyaks from Borneo, are of the slightest value as carriers in South Dutch New Guinea.

Sir Thomas Holdich, Vice-President (before the paper): In the absence of our President, who I regret to say is not able to be here to-night, I have one short announcement to make to you, which I am sure will be received with great pleasure by all of you. The Duke of Connaught has kindly consented to accept the position of Honorary President of the Society.

To the great majority of the audience here to-night, Captain Rawling will be an old friend. But for the sake of the minority who may not know quite what Captain Rawling's claims as a practical geographer may be, I will tell you that he commenced his career in the wild and windy wastes of Western Tibet. That was his first call. From there he brought back to us, I think, some of the first, if not some of the best, of the scientific surveys of that most inhospitable country that we have ever had. On that first occasion he succeeded in mapping some 35,000 or 40,000 square miles of country which was absolutely new to us geographically. Shortly after that, you may remember, he joined that memorable expedition which was led by Sir Francis Younghusband (whose recent accident we so greatly deplore), and on that occasion, in company with Captain Ryder, he carried a survey along the long valley of the upper Brahmaputra till he reached the source of that river and of the Sutlej, and thence they returned to India by way of Gartok. He then also brought to us a memorable supply of fresh geography, for I think they covered something like 40,000 square miles of country on that occasion. Subsequently Captain Rawling was recalled to Gyantse in Tibet. Finally he was selected by the Geographical Society to represent this Society in the expedition in which he has been recently engaged to New Guinea. You will therefore understand that Captain Rawling as a geographer is about as good a man as any of us could appeal to if we wished

to have a thorough knowledge of the subject in hand, and I will ask him at once to commence his lecture, which I know will be full of interest from first to last.

Sir THOMAS HOLDICH (after the paper): I am sure you will agree that New Guinea must be a country full of the most strenuous interest; interest which has been illustrated to you to-night by as remarkable a series of photographs as I think I have ever seen. I feel inclined, however, to envy Captain Rawling the pleasure he must have felt at finding himself face to face with a well-dressed audience. Judging from the photographs we have seen, I should say the beauty unadorned is not always adorned the most. I will ask Mr. Wollaston to speak to us if he will.

Mr. A. F. R. WOLLASTON: There is one thing in which I differ from Captain Rawling—and that is, he says Carstensz peak will never be climbed. I have studied that peak many times with field glasses, from a climbing point of view, perhaps fifty or sixty times, and I am fully convinced that there are on the south side at least two ways by which it might be climbed. At least one might reach the snow, and after the snow there is probably no difficulty at all in getting to the top. But I hope we may know more about it in time. Captain Rawling is very much to be congratulated on his most admirable lecture, and the description he has given us of the difficulties of climate and circumstance he had to contend with in order to produce this map we have seen and these most beautiful pictures.

Dr. ERIC MARSHALL: This morning I asked Captain Rawling if he would leave anything for me to say, and he replied, "Well, you will know after the lecture," but he has covered the ground so completely that he has left very little. Those who have any experience of the conditions of travel in the great plains and wastes of the tropical or polar regions may at first sight be rather astonished at the comparatively small area traversed and explored by our expedition during fifteen months in New Guinea. When one looks at the physical features, and the great difficulty in providing a suitable transport, this can be better appreciated. The country yields nothing upon which a white man can subsist, and even the native, when removed from his own district and adjacent sago swamp, finds it quite impossible to live on the scanty food which the jungle provides. Wallaby, pig, and cassowary are to be found in the jungle, and our knowledge of the few procured by the natives during our stay in the country shows us that enough of these are not available to support life when dependent on animal food alone. The mountainous districts provide nothing; sago swamps cease at about 10 to 12 miles south of the mountains. The dense jungle and knife-edged ridges are destitute of game, and as one rises up the spurs and slopes of the mountains, the birds, at no time plentiful, become very scarce. It is therefore necessary for the traveller to carry every ounce of food with him, eking it out whenever possible with any game which may be procurable. The ordinary Javanese or Dutch East Indian coolie can only carry about 30 lbs., besides his own bedding—that is, that he can only carry food for himself for fifteen days. Therefore it comes to this, that fifteen days is the limit of a single advance, unless depôts have been established and supplies accumulated at suitable points. In addition to this, there are certain standard loads which have to be accounted for and do not diminish in weight, such as tents, flies, bedding, instruments and cooking utensils, so that, allowing that one has Dyak coolies, who can carry a slightly heavier load, the final advance is very restricted. In the polar regions (Antarctic) it is possible for three men to travel, independent of any supporting party, hauling their own equipment and supplies, for from three months to even

four months, if relay work is undertaken. In the jungle and swamps of this part of New Guinea, three white men would require about thirty carriers for about fifteen days, and though you increase the number of coolies, you do not proportionately increase the length of travel, unless the coolies can be returned as their loads are consumed, and in order to do this many men must be employed in keeping the communication open, and they again must be fed. No expedition should stay in the country for more than nine months, for the climate saps the energies and strength of the white man, and even in this space of time it would be necessary to introduce fresh blood amongst the coolies. There should be no unnecessary delays in procuring these, so that from the time the expedition lands until it leaves, the work may go on without interruption.

An expedition should go in on the south coast, at the end of September or beginning of October, when it would have the best eight to nine months, and these none too good, of the year to carry out its work, for during the other three months it is impossible to make any satisfactory progress, and the percentage of deaths and sickness at this time is very much higher.

Dr. H. A. Lorentz: I was much interested to hear Captain Rawling's lecture to-night. I am perhaps the one that can best understand all the miseries of this expedition, because I experienced on my second expedition the same conditions. But as we see the results of this expedition, this map, the splendid series of photographs, the discovery of a Pygmy race, well, I consider it is my duty to bring my homage to those brave men who have so far succeeded. There are attractions in New Guinea which so influence one, that the desire is strong to visit this land again—at least that is my experience, and I hope that another British expedition may be formed, and I am sure that they will this time reach the Snow mountains, having profited by the experience they gained on this expedition.

Mr. W. R. Ogilvie-Grant: I think there is very little left for me to say after all we have heard, except to offer my most sincere congratulations to the members of our expedition on the splendid final success they have achieved. In the other room you will see a small selection of the mammals, birds, and ethnological objects which have been collected by the expedition, and I think when you look at the beautiful birds you will allow that they are quite as interesting as the natives which you have been shown—and possibly even more beautiful.

Dr. H. O. Forbes: I shall only detain the meeting a few minutes, but I should like, in response to your request, sir, to offer my sincere congratulations to Captain Rawling on the splendid work he has accomplished, the account of which we have just heard. With the exception of the members of the expedition, there are few perhaps in this room who can sympathize with him as I can in the extraordinary difficulties he had to meet. It was my aspiration to reach the top of Mount Owen Stanley, just as it has been Captain Rawling's to reach the top of the Charles Louis range. I experienced the same knife-edged ranges and deep torrent-swept gorges that seem to bar the flanks of the culminating peaks which rise in that long range of mountains that extends from the north of New Guinea down through Australia, and continues across the Antarctic continent, and through the Andes of South America. The same difficulties he had, I experienced with the natives both of the country and of the Indian Archipelago, who were my carriers, and I also had similar troubles with regard to beri-beri. It may be worth mentioning, perhaps, that some of the Malays, those especially addicted to the opium habit, in my camp were so ill as to be quite unable to walk, and as it was impossible for me to transport them to the coast, and equally impossible to leave them in the midst of people of a different race, I had great

anxiety as to their fate. I attempted to treat the disease with very little previous knowledge of it, by administering to these men internally the only medicament in my medicine chest I could think of likely to be of benefit, tincture of iodine, in very small and dilute doses at first, but increasing to about one minim daily, and I am glad to say, after several months, all these men who were at one time incapacitated from walking were able to reach the coast on their own feet. I should have liked to offer a few remarks on some of the very interesting observations made by Captain Rawling, such as the customs of the natives, the ethnological position of the "pygmies," and on the geological structure of the precipitous wall described by him; but at this very late hour I will only congratulate Captain Rawling that he has brought his company and himself safe back to civilization, despite the physical dangers they encountered, and the incessant disease they had to fight against.

Dr. MACKINTOSH BELL: First of all, may I say how very much I have enjoyed Captain Rawling's most interesting lecture? We have all realized, I am sure, what great hardships he has undergone. I for one appreciate what he has had to overcome, because I have just recently returned from New Caledonia, which presents somewhat similar though less serious difficulties. New Caledonia bears a marked resemblance to New Guinea in many respects. The physiographical features of the latter, if we can judge from the photographs which we have just seen, are very similar to those of New Caledonia. In the two islands there is apparently a coastal plain, while farther inland there are ridges of low hills deeply desiccated, and so much covered with vegetation that the rocks are almost nowhere visible. Beyond these lies in each case a mountainous hinterland. I should like to know if the mountains which Captain Rawling describes as showing a flat crest-line represent a desiccated plateau, that is an elevated surface of horizontal strata or a desiccated peneplain, that is a former base-level of erosion formed near sea-level and afterwards elevated. May I congratulate Captain Rawling on his most interesting paper? and I hope when his results are published he will give us some geological data as well as anthropological and geographical material. I should like to know if, in the mountains, the strata lie flat or stand at various angles?

Captain RAWLING: The strata of the rocks forming the great central range rise at an angle of 25° from the north to the south. It appears probable that two contrary earth-movements are taking place; the range itself being slowly forced upwards, while the land from the foot of the precipice to the sea continues to sink.

I have been asked as to whether the Mimika natives are cannibals. In our opinion they are not, for no signs of cannibalistic practices were seen by us. Several of the men had their front teeth filed to a point, a custom believed by many to be a proof of cannibalism, but our opinion is that in this district the filing, or rather chipping of the teeth, is only undertaken as a facial adornment.

Sir THOMAS HOLDICH: I think we may, in common with the last speakers, congratulate Captain Rawling on having brought a most interesting expedition to a safe conclusion. I have now only to ask you to express your thanks to him in the usual way for his very able lecture.

THE GEOGRAPHY OF NORTH-EASTERN BAHIA.*

By JOHN C. BRANNER.

The Drainage System.

Without going into a detailed description of the valleys and rivers, attention is directed to certain general features of the drainage of the region. These particular features are—

I. The structural valleys of the interior.

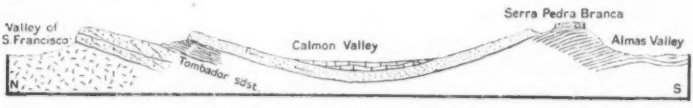
II. The drainage of the Serra de Jacobina.

III. The superimposed coast drainage and its development.

Some of the general results obtained will be stated as briefly as possible in this order.

The Structural Valleys of the Interior.—By structural valleys is meant valleys which owe their origin or form to their geological structure. Such valleys may be synclinal, anticlinal, or fault valleys. All three of these types are represented in the region between the Serra de Jacobina and the Rio São Francisco. It is impossible to even name in this place all the structural valleys; only a few of the more prominent and characteristic ones will be briefly mentioned.

The most noteworthy synclinal valleys are the Calmon valley, the Salitre valley, the valley of the Jacaré, the Campos Bellos valley, Rio Verde valley, the Paramirim, and the Santo Onófre. The axes of most of these valleys are approximately parallel with each other in the western part of the region; elsewhere they diverge greatly or even lie at right angles to each other. The Salitre valley has a general north-east—south-west direction; the Jacaré valley has a north-west—south-east direction; the Calmon valley runs east-west. In general structure these valleys follow the basins of long rock folds. The section across the Calmon valley here given shows the general structure of that valley toward its western extremity.



North—south section across the Calmon Valley.

A section across this same valley 50 kilometres further east would show the same general structure, but it would exhibit a somewhat different lot of rocks.

A remarkable feature of the Calmon valley is that structurally it continues far to the west and the south across the northern ends of the

* Continued from p. 152.

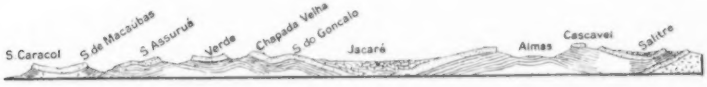
valleys of the Jacaré, the Verde, etc., and of the serras Assuruá, Chapada Velha, and Macahúbas. Its western end bends slightly towards the

North—south section across the east end of Calmon Valley, showing the relations of the Tombador quartzites of the Serra do Encaibro to the Lavras beds that overlie the Caboclo shales.

south, and south of Chique-Chique it follows approximately the axis of the São Francisco river.

Generalized east—west section across the Salitre Valley from the Serra de S. Mauricio to the Serra do Tombador, near Jacobina.

A section across the Salitre valley shows a somewhat different structure, but one that is in the main synclinal. Another section across the Salitre valley further north shows the same general structure, but with evidences of sharp folding after the deposition of the diamond-bearing beds and of denudation prior to the deposition of the Salitre limestones. A section across the structure about 100 kilometres south-east of the Rio São Francisco between Rio Santo Onófre and Alegre



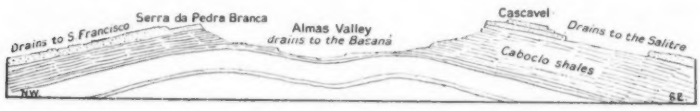
Section from Serra Caracol to the Salitre Valley, exhibiting the general structure and the relations of the stratigraphy to the topography. The part of the section south-west of the Jacaré Valley is by R. Crandall.

would exhibit this series of folds. Information received by Mr. Crandall in regard to certain topographical features of the Santo Onófre valley, taken in connection with the geology of the region east of it, leads to the conclusion that that stream flows along the trough of an elevated and gently folded syncline. In all of these cases it is evident that the geological structure is directly responsible for the forms of the valleys.

In passing it should be noted that these synclinal folds promise to be of great economic importance in this part of the state, owing to some of them affording promising sites for artesian wells. Anticlinal valleys are formed by the removal of the material along the axes of the anticlines, and of a necessity can exist only between synclinal folds. Examining the geological structure of the region, we find that valleys have been formed on the crests of anticlines at many places, but as a rule, and compared to the synclinal ones, these anticlinal valleys are short,

The Almas Valley.—The Almas valley is one of the most remarkable structural features in all this region. It lies in a triangle made by the Calmon valley on the north, Salitre valley on the east, and the valley of the Jacaré on the west. It is 40 kilometres long by 20 wide, and is surrounded by the highest peaks in all this region, some of them reaching an elevation of 1250 metres. The valley is drained by a stream that cuts a rugged, impassable gorge through its north side, and flows through the Calmon valley by way of the Basauá into the Rio São Francisco. Approaching the Almas valley from any route by which it can be entered, one finds himself always ascending a long and usually a steep slope with the rocks dipping towards him—that is, away from the valley. If he approaches from the north the rocks dip northwards, if from the south they dip southward, and so on. These general features alone show the Almas valley to be an anticlinal valley cut in a great dome. Inside, however, it was found that near the middle of the valley the rocks dip toward the centre. In other words, the main valley is a breached anticlinal dome with a small synclinal bowl in its centre.

The topography of the valley is carved in the soft Caboclo shales which here and there contain resisting planes that protect the beds



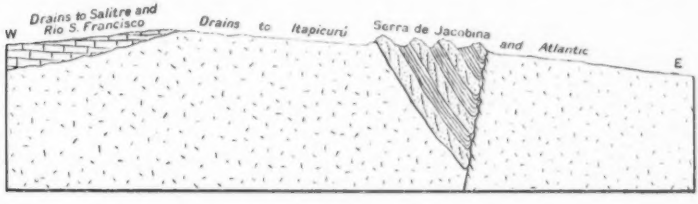
North-west—south-east section across the Almas Valley, showing the general structure and the Lavras quartzites capping the mountains and resting upon the Caboclo shales.

beneath, and stand out in the topography like tiles on a roof. The anticlinal axis is not always within the walls of the valley, however. In some places the rocks dip inward, showing the axis to be outside of the valley proper. From the general geological section on page 257 it will be seen that there are several other anticlinal valleys in this region.

Fault Valleys.—Only one considerable fault-valley has been noted—that is the Carrapato valley in the Serra das Lavras Diamantinas about 50 kilometres west of Lençóes. The rocks have there been broken and dislocated for a vertical distance of something like 300 metres. The Rio Carrapato follows the line of the fault for 20 kilometres. The total length of the fault is not now known (Crandall).

The Drainage of the Serra de Jacobina.—Attention is directed to one of the peculiarities of the drainage of the Jacobina range that has never before been correctly shown or even suggested on the maps. The Jacobina mountain range is from 1000 to 1200 metres high, and rises abruptly from the low region to the east. To the west the adjacent country rises very gently to the watershed that separates the Salitre valley drainage from the drainage flowing directly to the Atlantic, chiefly

by way of Rio Itapicurú. The topography and geology of this belt along the west base of the Serra de Jacobina are not strikingly different from the topography and geology of the plains to the east of the range. On both sides of the serra the rocks are mostly granites, gneisses, and the like, and here and there are fragments of quartzite ridges with the beds vertical. Water that flows down the east face of this range goes to form the various branches of Rio Itapicurú; but that flowing down the west face follows the direction of the mountain for a short distance, and then, turning abruptly right or left, cuts squarely across the geological structure, and passing through this range by mountain gorges, enters the various branches of the Itapicurú. This abrupt change in the direction of the streams on the west side of the mountain is not confined to one or two streams, but is characteristic of the drainage of the entire Jacobina range throughout a distance of some 200 kilometres. From Rio Jacuipe near Morro do Chapeo to Rio do Poço Comprido near Angico, all of the drainage from the Serra de Jacobina cuts across the structure of the



Ideal section across the Serra de Jacobina. The fault is hypothetical.

range and flows eastward. There are at least five such water gaps in the range, and possibly others, all of them with gorges between 300 and 500 metres deep where they pass through the mountain. Nowhere does a stream heading in this range flow into the Salitre river.

The geology of the region only adds to the interest in the case. The serra is made up of four parallel ridges of quartzite (itacolumite) dipping eastward at a high angle, while on both sides of the range the rocks are granites, gneisses, or other old crystalline rocks. The accompanying section will give an idea of the general geological structure. The quartzites that form the great mass of the Serra de Jacobina are extremely hard and tough. Alternating with them are soft talcose shales in which the parallel valleys are carved.

It is not clear as yet whether these parallel ridges and valleys are produced by four separate and distinct groups of quartzites alternating with three separate groups of soft rocks, or whether a smaller number of beds or groups have been repeated by faults running parallel, or nearly parallel, with the range.*

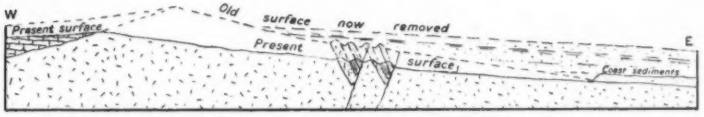
* "The Geology and Topography of the Serra de Jacobina," by J. C. Branner, *Amer. Journ. Sci.*, vol. **30**, pp. 385–392, December, 1910.

The most satisfactory explanation of the drainage of the Serra de Jacobina appears to be that of local adjustment within the range after a superimposed drainage had been let down across the geological structure.

Ideal section across the Serra de Jacobina on the theory of a double fault.

The following facts lend support to this theory :—

First, there is a belt of Cretaceous and Tertiary sediments along the coast, and the streams that cut the Serra de Jacobina flow towards and cross that belt. Second, the coast sediments are clearly the remnants of beds that formerly extended much further inland. It must be further assumed that the coast sediments formerly extended as far west as the Serra de Jacobina and lapped back across that range. The watershed between these east and south-east flowing streams was west of the serra and not far from where it is at the present time. The Serra de Jacobina was completely or almost completely buried beneath these sediments.



Ideal section showing the probable development of the topography of the Serra de Jacobina.

Earlier studies along the north-east coast of Brazil have convinced me that there was an elevation of this entire Bahia-Sergipe-Alagoas region during Miocene times. This elevation lifted the marine sediments from beneath the ocean, and the streams flowed down their slopes and eventually removed the new sedimentary beds, disinterred the mountain, and carved out the channels that now cut across the geological structure. As the serra was uncovered the smaller streams adjusted themselves to the geological structure, that is, they carved out short narrow valleys parallel with the main range in the soft shales between the quartzite beds, and left the latter as the outstanding ridges. As the crystalline rocks west of the serra are more easily attacked than the hard quartzites of the serra, the original watershed has been cut down more rapidly than the quartzite ridges of the serra itself. The accompanying section shows the probable course of the development of the region.

There may have been elements in the problem, however, that are not here taken into account. These uncertain elements may have been in the initial conditions, or they may have been in the operations of

drainage in adjacent areas, concerning which information is lacking, or both of these factors may have entered the problem.

Another possible factor in the shifting of the main watershed is concerned with the relations between the topography, the general direction of the winds, and the rainfall. It is a general geographical principle that the stronger drainage tends to encroach upon and absorb the drainage areas of adjoining smaller and weaker streams. Where the rainfall is larger on one side of the mountains than on another, other things being equal, the streams on the more rainy side will gradually enlarge their drainage basins at the expense of their neighbours on the side of the smaller rainfall. The result will be that the main watershed of the mountains will move toward the area of smaller precipitation. This sort of drainage has developed, and is still in process of development, along the crest of the Serra do Mar between Santos and São Paulo where the rainfall is greater on the ocean side than it is on the landward side. The streams on the Santos side are evidently more vigorous, and they have gradually encroached upon and absorbed the drainage area of the streams flowing toward the interior.*

Similar topographical relations may be seen in various places along mountains where the rains commonly come from a single direction. Noteworthy examples are found in the southern Andes between Chile and Argentina,† where the rains come from the west; and in the mountains of British Columbia, and in the Sierra Nevada mountains in North America, where the same thing happens.

In the case of the Jacobina range the winds blow nearly all the year round from the east and the south-east ‡ and the rains commonly come from the east, and the rainfall is noticeably greater on the eastern side of the serra than it is on the western. If the east and west slopes were originally alike, the stronger streams of the east would gradually encroach upon the weaker ones of the west, and the final result would be what we now have.

The Lime-choked Steam Channels.—In connection with this subject of rainfall on the Serra de Jacobina, mention should be made of the evidence of former greater rainfall over a large part of the interior of Bahia.

In the region west of the Tombador range are extensive deposits of

* In this case the steep east slope is also an important factor.

† P. Krüger, "Die Patagonischen Anden, etc.," *Petermanns Mitteilungen*, Ergänzungsheft 164, 1909. P. D. Quensel, "On the influence of the ice age on the continental watershed of Patagonia," *Bull. Geol. Institution of the University of Upsala*, vol. **9**, pp. 60–92. Upsala, 1910.

‡ See tables in 'Les côtes du Brésil.' Par M. Ernest Mouchez. 2nd edit. Plates following p. 272. Paris, 1876. See also "As chuvas no nordeste do Brazil." Pelo Dr. E. L. Voss. Bol. do Ministerio da Industria, Viação e Obras Publicas, **1**, 139–144. Rio, 1909. The tables given are all in keeping with my own observations.

limestone. These limestones cover most of the valleys of the Salitre, the Jacaré, and the Verde. The streams formerly carved their channels in these and other rocks, but subsequently this carving ceased, and the channels of the streams have been filled up with marly deposits of lime that have been brought in solution from the adjacent older limestones. Vegetation has gradually encroached upon these choked-up streams, and most of them are now overgrown by forests. Though the old stream channels are still clearly defined, they are no longer filled with flowing water. It is understood that these marl-choked and overgrown stream channels were carved out during the Miocene uplift, when the elevation of the region was sufficient to cause a much larger precipitation than the present one. The run-off of the water was also so great during the period of uplift, that there was comparatively little precipitation of marly lime deposits over the land and in the stream channels within that period.

The subsequent deposition of lime in these channels was brought about by a lowering of the region that caused a great diminution of the rainfall. As soon as this depression occurred the rainfall decreased so that the streams were no longer able to keep their channels open, the warming of the sluggish waters caused the carbon dioxide to escape, and the lime carried in solution was precipitated in the shallow streams until the beds were completely filled up. These changes probably came about slowly, and in proportion as the rainfall diminished the channels filled up and vegetation took possession of them, until now many of the minor tributaries are as completely covered by forests as any other portion of the region, while others like the Salitre, the Jacaré, and the Verde, and their larger tributaries, are still in process of being filled up and overgrown. It is assumed that the elevations here referred to took place during the Miocene Tertiary, but no conclusive evidence of its precise date has thus far been found in the interior. It can only be said that nothing has been seen either on the coast or in the interior that conflicts with the theory of the Miocene age of the elevation.

The Superimposed Coast Drainage.—A remarkable feature of the streams of Bahia, Sergipe, and southern Alagoas is that all of those east of the Serra de Jacobina have a pretty uniformly straight course to the sea. Even the great São Francisco, when once it reaches the region of the falls at Paulo Affonso, turns to the right, and, like the smaller rivers, enters the ocean at right angles to the coast-line. This uniformity of direction is the more remarkable because in the area of sedimentary rocks north-east of the Bay of Bahia *these streams all cut square across the geological structure.* For in this particular region the sediments lie in a basin that has granites on the west of it, and granites also form a belt from 10 to 20 kilometres wide between the sedimentary basin and the ocean, while the axes of the basin and the major folds and faults all run north-east from Bahia toward and past Alagoinhas, and the sediments extend past Bom Conselho, and Geremuábo to the Rio São Francisco in

the vicinity of Atalho above the falls of Paulo Affonso. When sediments are deposited in a basin or trough-like depression and are then lifted from beneath the water, the streams usually flow down the axis of the basin. Evidently this has not been the history of these streams. The solution of the problem lies in the fact that the courses of the rivers in this zone were determined by a series of marine sediments that have nearly all been removed by the ordinary processes of denudation.

In order to realize what has happened, we must go back to some time in the Eocene Tertiary period. The area was then depressed, and the ocean covered all the region along the coast as far west as the Serra de Jacobina, it extended some distance above the falls of Paulo Affonso, and covered a large part of Pernambuco and Alagoas. The land sediments brought down to the sea, the materials cut by waves from the shores, and the coral reefs growing in the sea accumulated over the sea floor, and as these sediments and growths were more abundant near the shores than further out, they sloped gently away from the land. After a long period of depression and silt deposition the region was raised from beneath the sea in Miocene times, and the initial slope of this new land surface determined the direction of the streams, and as the surface sloped gently seaward the main streams must have flowed down it, and were therefore approximately parallel with each other from the outset. The Rio São Francisco was no exception to this rule. The courses of the new streams were in no wise affected by folded or wrinkled beds or any other kind of rocks buried beneath these late sediments. The Miocene was a period of extensive denudation.* In north-eastern Brazil the streams first sank their channels deep into the soft beds, and later they reached and cut into the beds beneath. The courses of these streams being thus fixed, they continued to follow their original channels regardless of the structure of the underlying rocks. This is briefly what has happened in the Bahia basin. The drainage along the coastal belt is superimposed, that is, the streams have had their general courses determined by the new Tertiary beds when they were lifted from beneath the ocean, and have cut through the latter until they have reached and are now cutting across and into the underlying Cretaceous and older rocks. Such is the history of the Vasa-Barris, Rio Real, Itapicurú, Inhambúpe, Jacuípe, Pojúca, the Paraguassú, the Jaguaripe, and of many other streams in the southern part of the state of Bahia. Along the lower Itapicurú, that stream has cut through the Tertiary (and the Cretaceous) beds and deep into the underlying granites and gneisses. The largest streams soon cut their channels deep enough to enlarge their basins laterally also, and this gave rise to such streams as the Panéma, and

* Most of the history of the coast is based upon a study of the geology and physiography of the coast itself. The evidence is briefly stated in a former publication, "The Stone and Coral Reefs of Brazil," by J. C. Branner (*Bul. Mus. Comp. Zool.*, vol. **44**, pp. 8-33. Cambridge, 1904).

Moxotó in Alagoas, and to the many lateral feeders of the larger streams toward the south-west. The combined action of the streams rapidly removed the soft sediments over and through which they flowed. The thinner inland margins of these sediments seem to have disappeared almost entirely, and only here and there does an outlier bear witness to their former distribution.

Later History.—Since the great uplift of Miocene times, there have been only minor changes of level over the Bahia region. Some of these, however, have been of great importance on account of the modifications they have wrought in the coast-lines. The Miocene uplift hastened and intensified denudation, and a well-marked topography was developed along the coast. This period of rapid denudation was followed by a depression that carried the valleys near the coast beneath the sea, and formed many long narrow estuaries, most of them at right angles to the coast-line. The constant on-shore wind and waves cut rapidly into the soft sediments of the headlands, and most of the smaller bays or estuaries

Diagram to illustrate the geography and general geology of the lower Itapicurú, where it has cut through the taboleiro beds and uncovered the granites and old crystalline schists.

were promptly obliterated; but some of them, such as those along the coast of Alagoas, were shut in as coast lakes, and still survive in that form or as silted-up bays and lakes. The largest of these estuaries in the state of Bahia forms the present bay of Bahia.

This depression was not confined to the coast of Bahia, or even to the state, but probably included all of Brazil, or even all of the South American continent. The local effect in Bahia, besides the changes in the coast-line, was a diminished rainfall in the interior, a consequent decrease of the activity of the streams, and clogging of their channels by the precipitation of lime. Along the immediate coast, where the rainfall is always considerably larger than in the interior, the precipitation is sufficient to keep the channels open during most of the year. The modification of precipitation caused by the depression in late Tertiary times has produced a semi-arid region over a large area in north-eastern Brazil. The droughts that often affect that part of South America are due to these conditions that have clearly been operative since the Pliocene depression.

Conclusions.—Our travels and observations in Bahia, Sergipe, and

Alagoas lead us to the following general conclusions regarding the geography of this region, though all the facts supporting these conclusions are not here given in full.

1. The so-called Serra do Espinhaço does not exist as a definite mountain range in the state of Bahia.

2. Between the Serra de Jacobina and the Serra de Itiúba is a flat-floored north-south valley some 35 kilometres wide.

3. The retention of the name "Serra do Espinhaço," in the state of Bahia, is not warranted any further than may be necessary to suggest the general watershed west of Bomfim between streams flowing into the Rio São Francisco and those flowing directly into the Atlantic ocean.

4. The Serra de Itiúba is entirely a granite range.

5. The small serras and peaks scattered over the granite areas are partly of granite, but many of them are of quartzites with their beds in a vertical position.

6. The Serra de Jacobina is one of the oldest ranges in the region, and from it have been derived large quantities of sediments that have gone to form the later deposits.

7. Although the Serra de Jacobina is the loftiest range in this part of the state, this particular serra is not, as was supposed, the watershed between the Rio São Francisco drainage and the other streams flowing directly into the Atlantic.

8. The drainage of the Jacobina range flows east and west from its crest, but all of the west-flowing streams soon turn and cut squarely across and through this lofty range of mountains.

9. The drainage of the Serra de Jacobina is believed to be superimposed, but it has been further modified by the enlargement of the drainage basins of the east side of the serra, and by their gradual encroachment upon those of the west side owing to the greater rainfall on the east.

10. The main watershed south of Morro do Chapeo is made by part of the Lavras ranges, while north of Morro do Chapeo the main watershed is the Serra do Tombador, which runs parallel with the Jacobina range, but lies 25 kilometres west of it.

11. The heavy beds of sandstone and quartzite that cap the Serra do Tombador formerly extended 25 kilometres further east, and rested against the flanks of the Serra de Jacobina, which was then considerably higher than it now is.

12. The limestone region west of Jacobina and Morro do Chapeo and the Salitre valley area are characterized by abandoned river-channels that are now never filled with water, but are choked up with deposits of lime marl and overgrown with forests.

13. These old channels are believed to mean that the rainfall of this region was formerly very much greater than it is at present.

14. Such a rainfall was probably due to the former greater elevation of the entire region, including the Jacobina range, that occurred during Miocene Tertiary times.

15. Rio Salitre, formerly supposed to rise due west of Bomfim, and to have a total length of 100 kilometres, is found to rise a couple of leagues north of Morro do Chapeo, and to have a total length of 260 kilometres or more.

16. Rio Jacaré, hitherto supposed to rise west of Morro do Chapeo, and to have a length of 160 kilometres, is found to rise in the Chapada Velha, north-west of Lençóes, and to have a length of 340 kilometres.

17. Another stream, the Basauá, a hitherto unknown and unmapped tributary of Rio São Francisco, has been mapped throughout most of its length. It has a length of 100 kilometres.

18. Many other streams and many serras hitherto unknown or but vaguely known have been mapped, and the general geological structure of the region has been determined.

19. In the region between the lower Salitre and the Jacaré is a great valley running parallel with the Rio São Francisco. North of this valley are two mountains—the Serra de Encaibro and the Serra do Tombador. South of it rises the lofty white diamond-bearing Serra da Pedra Branca. To this valley we have given the name of "Calmon," in honour of the minister under whose enlightened administration scientific work in Brazil has been revived.

20. Structurally, the Calmon valley is the eastern end of a great synclinal fold that extends across the lower ends of the valleys of the Jacaré, Rio Verde, Rio Paramerim, and, crossing the Rio São Francisco at Chique-Chique, extends up the valley of the Rio Grande, probably determining the general course of the latter stream.

21. South of the Calmon valley and between the Salitre and the Jacaré is a valley of remarkable structure—the Valle de Almas, a great anticlinal dome with a synclinal basin in the middle of it.

22. Over the region, west of the Jacobina range especially, the prominent topographical features have been shaped by the geological structure, the resisting lavras quartzites forming most of the ridges, the valleys being cut in the Caboclo shales.

23. The structural geological features that have determined the topography of this region continue to the south and west, and, crossing the Rio São Francisco, probably enter Goyaz, Piauhý, and Ceará.

24. The coast sediments that now cover but a narrow zone near the ocean, formerly lapped back over a much wider belt and extended probably as far west as the Serra de Jacobina.

25. The rivers of the coast zone, the Rio São Francisco below Paulo Affonso included, are all superimposed streams whose courses have been determined by the initial slopes of the last considerable Tertiary marine deposits when they were first lifted from beneath the ocean.

26. Finally, we have represented in the region discussed a remarkably long and complex geological and geographical history, and a splendid geological structure that is not surpassed by the famous Appalachian ranges of North America or by the Jura mountains of Europe.

The principal geological events in the development of the present drainage of the state of Bahia were as follows:—

1. During the Cretaceous, and probably during the early Tertiary, the ocean covered all of eastern Bahia as far west as and including the Serra de Jacobina, and the Rio São Francisco entered the ocean somewhere above Cabrobó.

2. During Miocene times the entire region was elevated, and the streams flowed into the ocean down the gentle slope made by the marine sediments. This slope determined the general direction of the larger streams, and also of the Rio São Francisco from Cabrobó to its mouth.

3. At the time of the Miocene uplift the watershed between the drainage flowing through the Salitre valley into the São Francisco and that flowing directly into the Atlantic was west of and not far from the present Serra de Jacobina.

4. The Miocene uplift gave rise to a larger precipitation than that of the present time, and the streams eroded their channels deeply, removing large quantities of the early Tertiary and Cretaceous sediments.

5. The streams flowing south-eastwards from the Salitre watershed stripped away the landward margins of the Eocene and Cretaceous sediments, and uncovered and cut deeply into the quartzite ridges that form the present Serra de Jacobina.

6. In time the drainage of the Serra de Jacobina region adjusted itself to the geological structure, excepting the large superimposed streams which cut directly across this structure.

7. During late Tertiary times there was a depression of the region and a consequent diminution of the rainfall of the interior. The streams dried up or became sluggish, ceased to cut their channels, and lime was precipitated in the pools and shallow waters until they were filled up with marl, and were finally taken possession of by vegetation.

8. Along the coast the depression submerged many narrow valleys and turned them into estuaries.

9. The encroachment of the sea upon the land and the throwing back into the estuaries of the sediments cut from the headlands first turned these estuaries into shallow lakes, but further encroachment obliterated most of them. The coast lakes of Alagoas originated in this manner.

10. The bay of Bahia is a submerged group of valleys carved out during Miocene times and depressed and flooded during and since the Pliocene.

APPENDIX.

In order to give some idea of the altitude of the diamond-bearing highlands and of the region south of the Rio São Francisco and west of the São Francisco railway, I append here a list of elevations. These determinations were made with aneroid barometers. The names of the observers are given in each case.

LIST OF ALTITUDES IN THE INTERIOR OF BAHIA.

Point.	Region.	Authority.	Elevation.
			Feet.
Abreu, sitio	Escurial estate, west of the Salitre valley	Branner	970
Achado estate	America Dourada	,,	780
Alazão estate	Salitre valley	Crandall	615
Algodão estate	Watershed between Rio Salitre and Rio Poço Comprido	,,	955
Almas, village	Almas valley	Branner	840
America Dourada, village	West of Morro do Chapeo	,,	680
Assuruá, Serra do	—	Sampaio	830
Baixa Grande estate	Salitre valley	Crandall	520
Balança	Watershed between Escurial and Ingazeira	Branner	1175
Bocca da Madeira estate	North of Morro do Chapeo	,,	900
Bocca do Cedro estate	South of Morro do Chapeo	,,	1015
Breijão village	Rio Salitre	,,	715
Breijo de Gamelleira	Serra do Assuruá	Williams	600
Breijo do Meio, sitio	Rio Ingazeira	Branner	900
Caboclo peak	Jacobina Nova	,,	1255
Cacimba estate	Rio Cacimba, west of Salitre	,,	540
Cacimba, Serra de	West of the house	,,	700
Cachoeira do Sumidouro	Rio Ingazeira	,,	730
Cahyé river	Jacobina-Bomfim road	,,	500
Cambão	Ingazeira estate	,,	1040
Campinas, village	South of Morro do Chapeo	,,	890
Cascavel, peak	Jacobina Nova	,,	1260
Chapada Velha, village	—	Crandall	1135
Curralinho, peak	Escurial estate	Branner	1175
Encaibro, Serra do	Rio S. Francisco	Sampaio	750
Fumaça river	Bomfim-Saude road	Branner	445
Gaspar, estate	Alto Salitre	,,	650
Gongorra, Riacho de	Almas valley	,,	780
Gruna, Serra dos Meninos	Jacobina Nova	Crandall	1130
Itibira, Serra de	Rio S. Francisco	Sampaio	790
Ingazeira, Rio	Mouth	Branner	500
Itapicurú, river	Saude-Bomfim road	,,	430
Jacobina, city	South-west of Bomfim	,,	500
Jacuipe, river	Ventura-Canna Brava road	,,	540
Jacuipe, river	Gavião-Sta. Luzia road	Crandall	240
Limoeiro, village	Rio Basauá	Williams	580
		Branner	600
Monte Alegre, village	West of Sta. Luzia	Crandall	450
Morro do Chapeo, city	Centre of the state	Argollo	1260
		Branner	1000
		Crandall	1020
Morro do Chapeo, peak	—	Branner	1275
Morro Redondo	Rio Batateira	,,	1255
Pedra Branca, estate	Rio Pedra Branca	,,	550
Pico Nabuco	Escurial estate	,,	1255
Poço Comprido, Rio	North of Itumerim	Crandall	595
Porteira, river	Jacobina Nova	Branner	750
Redoleiro, village	Jacobina Nova	Branner	845
		Crandall	850

Point.	Region.	Authority.	Elevation.
			Feet.
Sahy, Missão	South of Bomfim	Branner	590
Sant' Anna, peak	North of Bomfim	Crandall	1115
		Branner	1100
Sto. Antonio, Serra	West of Campo Formoso	,,	980
São Mauricio, Serra	West of the Salitre	,,	1040
Tabor, Monte	South of Bomfim	,,	850
Tombador, Serra do	West of Jacobina, Jacobina-Xique-Xique road	,,	930
Tombador, Serra do	Ventura-Canna Brava road	,,	945
Morro da Mina	West of Bomfim	,,	950
Campo Formoso, village	West of Bomfim	,,	600

LAKE CHAD.

By P. A. TALBOT.

On January 23, 1911, we left Mani on the Shari, and set out for Hajer el Hamis. This was reached towards evening, just in time to catch the sunset glow on the waters of Chad, shimmering through its fringe of trees. Morning dawned over the four strange little hills of Hajer el Hamis. These are formed of rhyolitic granite, and spring from a plain as level and bare as the palm of the hand. The highest of them stands alone, so close to the lake as to mirror itself at times in the water, while the other three cluster together a little way off. The place is supposed to be peculiarly holy, for there is a tradition that the ark rested here when the flood began to go down, and that from this spot Noah and his beasts set forth to re-people the earth. A few hundred years ago, it was the place of pilgrimage for all this part of Africa. Then—as our headman explained in his quaint pidgin English—" Men lived to cry for Chad—Mekka be good past this." So the tide of pilgrims turned eastward. Even at Mekka, however, the place has still a reputation for sanctity. Not long ago, a chief from a neighbouring village arrived there, and explained to one of the Head Mallams whence he came. On this he was astonished to be asked, " Why do you come all this way, when in your own land you have so holy a spot ? "

In answer to inquiries as to the best way of ascending the various hills, we were told that several Frenchmen had climbed to a sacred cave in one of them. So far, the guide explained, there was a road, *i.e.* a way of getting up, but asserted, with many gestures expressive of the utter hopelessness of the idea, that the other hills were unclimbable. They looked somewhat difficult, so we decided to take the easiest first. A few minutes' scramble brought us to a rough platform outside a tent-shaped cave, or rather rocky hall—open at both ends.

Here in the old days, when human flesh was of little account, captives were sacrificed, to ensure a favourable answer to their master's petition.

From the left side of the entrance springs a great flying buttress—while facing it towers a rock of columnar formation, bearing, low down on its face, a small cave tenanted by countless dun-coloured owls and pigeons of an indescribably beautiful blue. Between the two adjoining hills lies what, in northern latitudes, might be mistaken for a moraine. This rises to 50 feet above the present level of Chad, yet its whole length is strewn by stones and boulders rounded from water action.

At the head of the little ravine lies the most beautiful point of the whole miniature range. To the right, at a sudden bend, a colossal archway springs into view. This is, roughly speaking, 300 feet from base to summit, and extends right through the north side of the hill. It loomed before us, unexpected, dark and sinister, much as the gate of Pluto's realm must have yawned before the eyes of the startled Proserpine, when first carried off from the sunlight down to the nether world. A vaulted way, 90 feet high, 70 feet in length, and only slightly less in breadth, leads into an inner court, surrounded on three sides by almost perpendicular walls. Those facing the entrance and to the left are comparatively low, not more than 60 feet, but once climbed, show on the other side a drop of over 100 feet. To the right, along the whole length of the court, runs a magnificent gallery nearly 200 feet high, and curved over at the top as if to meet the arch of the blue sky. Above in the clear air hawks circled round and round, reminding one of the ravens of Barbarossa. Indeed, everything about the place seemed set apart from the everyday world one had left behind, and to breathe the spirit of half-forgotten centuries with their dim legends and forsaken faiths.

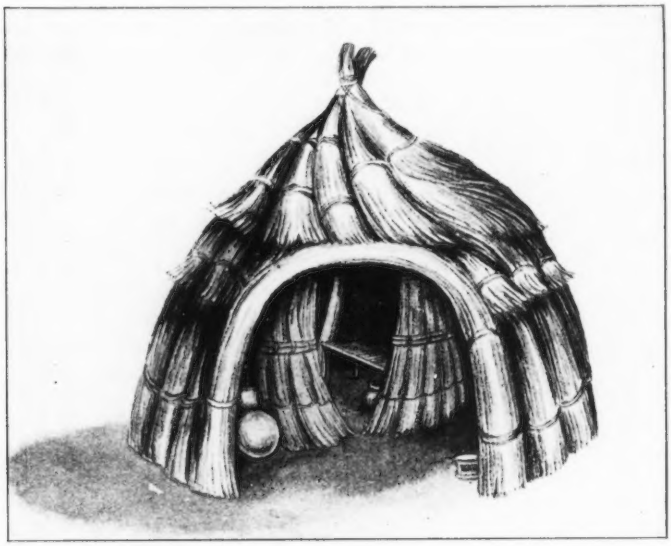
Here, too, as in the first cave, slaves were formerly sacrificed, though now no more costly offering is brought than an occasional sheep or goat. Little wonder that in the simple minds of the natives such a spot should have acquired a reputation for sanctity and magic properties, when to matter-of-fact northern eyes like our own, even in the blazing sunlight there was something awe-inspiring about it. By moonlight no more suitable scene could be imagined as a gathering-place for the beings of the Götter Dämmerung, while the straight high ramparts seemed made for the rush of Valkyrie. Of modern painters, Böcklin alone perhaps could have caught the spirit of the scene.

After a thorough exploration of the rest we set out, to the consternation of our followers, for the highest hill, which stands a little apart. This really presented considerable difficulties and it was only after several attempts, and by discarding our boots, that we managed to gain a foothold on the bare rock. After a hard climb we reached the summit just before sunset, to find, perched on the very top, what we at first took for a small cairn commemorating the visit of previous explorers. One or two of the more enterprising of our men had followed us part of the way, and these, as well as the people of the neighbourhood, assured us that, to their certain knowledge, the hill had been unclimbed within the memory of man. On

Sketch of a route across
LAKE CHAD
by
P. A. TALBOT, B.A.
Feb. 1911
Scale 1 500,000 or 1 Inch = 7.89 Stat. Miles
Soundings in Feet
Route
Note
This map is based upon a compass and watch traverse across the Lake adjusted to the astronomically determined positions of Kaua Baga, Woro and Mouth of the Shari River
Delta of the Shari R.
Kwadu
Bula
Kuka
Kulli
Thuku
Papyrus
Ambach
Kaua Baga
Kuka
Mele
Kulli
Kangallam
Kaiga
Chilum
Thin reed
Seyorum
Bul
Yo Gana
Bukkola
Belanga
Kulli
Ba
Mogureram
Alam
Much drift wood
Reeds
Marrie
Kaiga
Bula
Kwadu
Papyrus
Ambach
Thuku
Kulli
Korta
13°
14°

closer examination, too, the stones appeared to have been set up by Nature's hand rather than human agency. Twilight fell soon after we began to descend by what seemed an easier route. Just before dark, however, the way was blocked by a sheer drop of about 15 feet, on to a little ledge less than a foot wide. There was no time to return, and, but for one of our men, who worked round to the spot immediately below and braced himself against the rock to catch us as we dropped, we should have been obliged to spend the night on Noah's deserted resting-place. The whole hillside proved to be a series of such drops—and we were glad enough to reach the bottom at last.

During our visit to these hills the Sultan of Mani had sent four Buduma



BUDUMA HUT WITH WIND SCREENS. KUMU, LAKE CHAD.

men to Jimtilo to await our return and act as guides across the lake. On our arrival they told us that the shortest way would be straight to Seyorum (Haiyorum), in which case we should see no land at all. This journey could be done in three days, but as we were anxious to visit some of the Buduma towns, we decided to follow a longer route. Our way led down the Shari, between banks fringed with deep belts of papyrus, so tall as to look in the distance like young palm trees. It is from the smooth straight stems of this wonderful reed that the Buduma canoes are made. These boats are, perhaps, in their way, the most marvellous in existence. They are formed entirely of long bundles of papyrus laid layer upon layer, and lashed together by native rope, and are so stable that even the sudden

BUDUMA BOATS LADEN WITH POTASH: MOUTH OF THE SHARI.

VIEW FROM SAND-DUNE AT KUMU.

PAPYRUS ON LAKE CHAD.

GURIA BUDUMA.

violent storms of the lake seldom or never sink them. A thick bundle is first bound together, of one length of papyrus only, if for a small boat, but sometimes of two or even more. This forms the keel, and from this the whole boat is gradually built up. Those meant for cattle transport have an additional thick float, built out on either side at the level of the water. This broadens into a width of several feet towards its middle, and narrows to stem and prow.

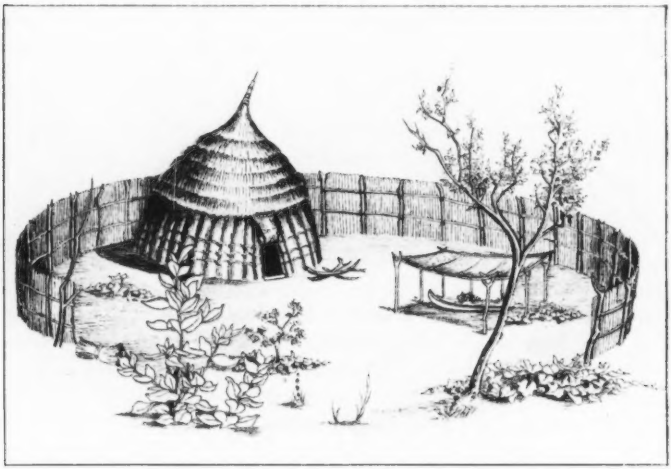
We meant to cross the lake in Buduma boats, but only small ones were available, and it would have taken too long to wait till larger ones could be procured. We therefore decided to continue in the Kotoko canoes which had brought us up from Gulfei. These too were interesting enough craft, formed of planks of wood of all sizes and shapes sewn together by thongs of raw hide, and the interstices made water-tight by thick bands of reed. They were 45 feet long, with a gondola-like stern and a prow over 5 feet broad. It is curious that they should be propelled broad end forward, but this custom is probably due to the fact that when fishing the nets are always stretched out before the boat.

Six hours after leaving Jimtilo, we pitched camp at a Buduma fishing station near the mouth of the Shari. It was our first chance of studying this interesting people under favourable conditions. When in their neighbourhood some years before, they had been too shy to admit of a near acquaintance, and those whom we had seen settled near Jimtilo had so intermarried with Arab and Kanembu as to lose all distinctive characteristics. The men at the fishing camp showed us the greatest courtesy. They looked on with smiles of the utmost good breeding while our little lion cubs played with, and possibly damaged, their fishing-nets. They lent their great curved shields of ambach wood ornamented with hide, to serve, arranged tortoise-wise, as shelters for our men, and showed us their own little contrivances against the biting winds of the lake. First twigs are bent over and both ends fixed in the soft earth, to form a tiny hut about 1½ foot high. On these closely woven mats of a convex shape are placed. Sand is then piled round their edge save at one spot, through which, beneath the lifted mat, the owner creeps. Once inside he makes a low pile against the entrance, to complete the circle, and then curls up in the narrow space and goes to sleep. So closely woven are these mats that they are quite mosquito-proof, and, even in calm weather, are used in preference to houses, as they give protection from these pests.

In this camp we were stormbound for three days, which would have been a cause of greater annoyance to us had it not been that game was plentiful. A kob and a couple of fine water-buck were bagged, much to the joy of the small lions and of the carriers. We ourselves made an effort to eat a leg of the buck, but failed miserably. It is curious that, though feeding entirely on grass and leaves, as is the case with its delicately flavoured brethren, the flesh of this beautiful antelope should be so unpalatable. With us, too, were stormbound a little fleet of Buduma

canoes, laden with earthenware pots, which their owners had bought in exchange for potash.

On the morning of the fourth day the wind had dropped enough for us to set out again. No sooner, however, had the shelter of the banks been left than the waves were found too strong for safety, and we were forced to take refuge on an island in the delta. From this point of vantage we looked out over line upon line of breakers stretching to the horizon. By midday a fresh start was made. We were on Chad at last, but the waves were still high enough to strike terror into the hearts of our Kotoko paddlers, who had never before dared its perils. The Buduma look upon it as their



BUDUMA HUT WITH WIND SCREEN ROUND COMPOUND. BULARIGA, LAKE CHAD.

own private preserve, and fend off all intruders by blood-curdling stories of the dangers which lurk beneath its waters. In this way they keep the trade of the lake, which is very considerable, in their own hands.

All day we poled and paddled, mostly the former, for the latter mode of progress was only resorted to when the water was more than sixteen feet deep. At night we anchored in a little harbour formed by a belt of ambach trees, which rise from a depth of about 12 feet, and from a distance give the delusive idea of land. These strange trees, with their delicate foliage, and flowers like a flight of apricot-coloured butterflies poised amid the leaves, formed a safe shelter from the rough waves and cold winds of the lake.

As twilight fell the stars came out one by one. The whole scene, shut in on the one side by its moon-shaped belt of trees, darkly mirrored from below, and open on the other over what seemed an endless space of water, had the quality, not so much of a painting as of some wonderful old

engraving, dark and soft. The fascination of Chad was all around us, in its mysterious shadows and faint, quivering lights, the charm of the unknown and unexpected, for till now we had imagined it only as I knew it to the north, a more or less shallow expanse, mostly overgrown by rush and weed.

Of the eight days spent upon the lake, five passed without sight of land. Often for hours together nothing could be seen but low lines of papyrus or ambach at certain points on the horizon, though more usually solid-looking stretches of the former or clumps of the latter lay close to our route. In such cases the Buduma, for whom each of these patches of verdure has a name, steered from one to another. So well is the lake known to them, however, that they held an unerring course, even when, far as the eye could reach, not a single twig rose to break the monotony of the surface.

The first three days were so cold that not only did we ransack our wardrobes for every warm garment they contained, but even at midday were obliged to wear several coats, one above another. The prevailing winds came, as might have been expected, from the N.E. and N.N.E. The third night was spent on the island of Kumu, inhabited by Guria Buduma. These people were most polite and friendly. They seemed pleased to sell us all the curios we wanted, and made no objection to our visiting their houses. The latter had a character peculiarly their own, owing to the different types of wind-screens invented as a protection from the biting cold and fierce storms of the lake.

More or less in the centre of these islands lies a sand-dune about 50 feet above water-level. We were told that when the lake rose, the people were obliged to retreat thither. They assured us that this happened at times, but they had never known the water to fall appreciably below its present level. Everywhere floats of ambach (*Hermininiera elaphroxylon*) were to be seen. This wood, called by the natives Maria, is not more than one-fifth the weight of cork. The floats are roughly shaped in the form of a shark, and on these, both men and women can lie and swim nearly as fast as a man could run.

The people are decidedly picturesque; both sexes have clear-cut, refined features, but the women are decidedly the handsomer. Many of them wear elaborate coiffures with several earrings of the "gipsy" type in each ear. The men wear only one—a crescent-shaped silver disc—always in the left ear.

Next night was spent on the island of Belariga, where the inhabitants, Majagodia Buduma, were even more friendly than those of Kumu. It was not difficult, by the exercise of a little patience, to get them to tell us about many of their customs, legends and beliefs, and even to induce them to allow anthropological measurements to be taken, though the latter measure could not be called popular. Some even went so far as to mention that they would rather not have the new "medicine" tried on their heads.

A third island was seen to the west, and when asked if there was any village upon it, they answered, "Not for people, only cow town." On leaving our friends at Belariga, we made for this island, which they called Kika. It was deserted, even by the cows, but an evening stroll revealed the fact that it abounded in animal life. Leopard tracks led in almost all directions, a hare sprang up from some short rushes, almost at our feet, hippo grunted from the water, and a dama gazelle, terrified at the crack of a rifle, bounded off like lightning on our approach. In all, nine different kinds of mammals were found on the island. Probably these originally came from the northern shore of the lake, presumably at a time of very low water, as it is unlikely that some, hares for instance, would have risked a long swim through deep water. It seemed extraordinary to find so many of the gentler kind of fauna living in such close proximity to their hereditary foe—the leopard.

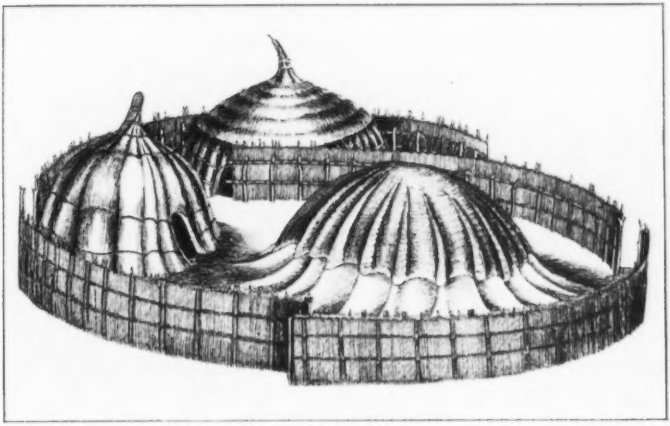
Next morning we came on an abandoned settlement, which looked as if made for the "Little People" themselves, the tiny houses were never more than 3 feet high. This was the "cow town," pointed out to us from Belariga. After a successful drive, we set out once more and so soon passed the last piece of solid land which we were to see before sighting the shores of British Bornu. Three more days were spent upon the waters, mostly amid ambach clumps, though now and again an unbroken surface stretched far as the eye could see. For several hours before entering the shallow zone, gay with water-lilies, blue, white and mauve, interspersed with reed, which stretches along the peninsular of Seyorum, nothing could be seen but long lines of verdure on the horizon.

As by a happy series of coincidences had been the case all through our journey, we landed at Seyorum, just at the most interesting time, when the potash market was in full swing. This is perhaps the biggest mart of the kind in the world; its size may be gauged from the hundreds of Buduma canoes, drawn up along the shore, and from the number of caravans that come down to carry away the potash and circulate it not only through Northern and Southern Nigeria, but practically along the whole West Coast of Africa. For this article the Buduma only act as intermediaries, but they also bring dried fish, often of enormous size, caught in multitudes by their slaves. In exchange, they purchase cloth, millet, spears, and ornaments of silver and iron. Occasionally, too, they carry passengers, mostly traders from the Central Sudan, who bring dollars, with which to buy the embroidered robes of Bornu.

It was of particular interest to those of our party who had had the pleasure of listening to Captain Tilho's most interesting paper read to the Royal Geographical Society a year before, to notice how much our route differed, both in depth and expanse of water, from those described by him. Unfortunately, here in the depths of the African bush, no material is available for determining whether or not our route had already been traversed, or if the difference between our experiences and his was due solely to a

change in the lake itself. The first seems most probable, as all Buduma questioned on the subject stated that the water never sinks more than a foot or so below the level at which we found it. As can be seen from my line of soundings, the average depth right across was 10 feet.

The water, too, was beautifully clear, cool and sweet, and, so far as could be told from taste alone, without a trace of salt. Contrary also to the experience of Captain Freydenberg, we found the deepest water (average 11 feet) round the islands, the next deep (average 9½ feet) between these and the coast of Seyorum, and the shallowest (average 8½ feet) between them and the mouth of the Shari. On several occasions the men could not use



BUDUMA COMPOUND, SHOWING WIND SCREENS AND MOSQUITO-PROOF SLEEPING-PLACE. BULARIGA, LAKE CHAD.

their 17-feet poles, and had to take to paddles, but for no long distances. This probably only indicated small depressions.

On the whole the portion of the lake traversed, produced the impression of a splendid waterway. Should the Northern Nigeria Railway ever be continued to Bornu, which, considering the immense trade of the latter province and the easy country through which the line would run, would surely more than repay expenditure, there seems no reason why a regular service of steamers should not be kept up from Seyorum to Fort Lamy on the Shari, and the 4-mile-distant German capital of Kusseri. By this means letters and merchandise would reach the Central Sudan in a less number of weeks than it takes months at the present day, and the magnificent cotton-growing territories of Eastern Nigeria and French Central Africa would be opened up. Such a scheme might perhaps be worth the attention of the British Cotton-growing Association. Though it would be a matter of regret to some should the waters lose their mystery and become a mere commercial high-road.

Possibly the strange fascination which Chad has exercised over so many is due to the fact that she seems never to give the same impression to any two of her visitors, and shows such varied characteristics in different parts. Surely she may be called the Cleopatra among lakes, for, so far as can be judged at present, many years will come and go before exploration can make her known to us, or "custom stale her infinite variety."

ANTARCTIC NATURE, ILLUSTRATED BY A DESCRIPTION OF NORTH-WEST ANTARCTICA.

By Prof. OTTO NORDENSKJÖLD.

THE *Geographical Journal* has already published several articles dealing with the scientific results of the South Polar explorations of recent years. My object in this place is only to deal briefly, in connection with the scientific work of the Swedish expedition, a summary of the geographical part of which will soon appear,* with a few questions of general importance for the understanding of the nature of the Antarctic regions, and especially those aspects which are characteristic of them, as well as touch on a few points of nomenclature and exploration researches in those parts.

1. *General Orography and History of Development.*

The zealous researches carried out during the last decade by a number of South Polar expeditions have yielded us, in the first place, a general idea of the nature of the Antarctic world. Through the expeditions of Captain Scott and Sir Ernest Shackleton, which dealt with a region covering 15° of latitude, of the greatest geological importance, we have become acquainted with horizontally stratified rocks on an apparently even, peneplain-like base of archæan rocks, which with their covering of ice form what is probably the greatest plateau region in the world. There is reason to believe that the same rocks form the whole continental mass south of the Indian ocean, which we might call East Antarctica; it seems to form a continuation of the Indo-African continental mass, which consequently surrounds the Indian ocean on *all* sides, and prevails over a third of the surface of the Earth.

The conditions are in every respect quite different on the long, narrow peninsula that projects to the north and lies due south of South America. The central parts of this territory were explored by the Swedish

* 'Wissenschaftlige Ergebnisse der Schwedischen Südpolar-Expedition, 1901–1903, unter Leitung von Dr. Otto Nordenskjöld.' (Stockholm, 1904–11.) Hitherto (May, 1911) there have appeared forty-five special treatises, distributed among six volumes; the geographical part, by the present author, will appear in the course of the year.

expedition; in the south-west, on the granite coast, de Gerlache and Charcot have worked; in the extreme north-east, on the South Orkneys, Bruce. This region forms, geologically, a continuation of, or at any rate a perfect analogy to South America; and the more we have studied the collections brought back by our expedition, the more striking is the correspondence in detail.* Just as in South America, the land is built up of a western mountain-chain and an easterly, partly volcanic plateau-land, and in both regions the mountain chain is of an unusual type in that it consists chiefly of abyssal rocks of a particularly characteristic appearance, mostly granodiorites of the type we have been long accustomed to call the Andine. This applies in the first instance to the west chain of the South American cordilleras and to the Antarctic central zone; the eastern zone in both regions also reveals great resemblances—in both there are to be found fossiliferous, slightly folded Jurassic strata; and several characteristic types of the boulders collected in Antarctica are puzzlingly like some of the rocks in Tierra del Fuego. Only the South Shetland group in the south forms an isolated, extreme zone of basic and partly propylitic volcanic rocks, which have no direct correspondence with those in Patagonia.

Not less great is the resemblance between the regions of the more easterly plateau. In both the oldest horizontal strata consist of Upper Cretaceous, probably Senonian, and, in the districts examined by us, very rich in fossils. Then came an intermediate period, when both regions rose above the sea, after which during the Middle Tertiary Period, Upper Oligocene or Lower Miocene, a new transgression set in, which in the Antarctic coast of King Oscar II. Land reached a height of at least 800 feet (250 m.). In a coast formation belonging to the lowest strata of this series, I discovered the remains of a rich flora, some seventy species being distinguishable in the material taken home, though they are not all determinable. A few of these forms (of the genus *Fagus*) are identical with species collected by me in 1896 in the Tertiary sandstones of Tierra del Fuego; for the rest they show a close relationship to the present flora of South America, partly to Patagonian species (Caldcluvia, Drimys, Lomatia, Nothofagus, etc.), partly also to sub-tropical forms from more northerly parts (Mollinedia, one Araucaria, several ferns, etc.). That these types of flora grew on the rocky islands which at that time rose here from the Tertiary sea, is highly probable, and even if it were possible for them to have been carried for some distance by ocean currents, still they show with some certainty that the climate of this period of the Tertiary era was moderately warm in these parts. This is the more certain because also the Tertiary molluscous fauna, closely related moreover to the contemporary Patagonian, must have

* The similarity in structure between the South Shetlands and Tierra del Fuego was pointed out by John Barrow in vol. 1 of the *Journal* of the Royal Geographical Society.

lived in a warm or temperate sea.* Together with this marine fauna we also came across, in one place, remains of vertebrates, especially several species of penguin. Contemporaneous with the sinking of the land which ushered in the formation of these sedimentary rocks, an active volcanic activity prevailed, which in a way may be said to have continued down to recent times. Thus, a few small rock islands (especially Paulet island) show a still tolerably well-preserved crater form; the occurrence of active volcanoes on this coast, however, as has been sometimes reported, I hold to be highly improbable. The chief volcanic activity probably took place towards the end of the Tertiary Period, when the climate had already begun to be cold, and then was formed James Ross island (about 7000 feet in height), which consists mainly of tufa with layers of Cretaceous sandstone visible here and there at its foot.

An interesting series of still younger strata was found by J. G. Andersson on Cockburn island, which has been known to us ever since Sir James Ross's journey. This is the so-called Pecten conglomerate; its fauna has a very recent character; thus, of twelve discovered bryozoan forms all are still living, some in Antarctic waters, others, again, on the South Australian coast. Both Hennig and Buckman, who have described the fauna in papers in the geological part of our work, consider it likely that this formation belongs to the oldest Quaternary; in that case it is of great interest in determining the epoch when the ice began to cover this territory.

Also in certain morphological features this territory presents a great resemblance to South America. I may call special attention to the marked development of "canals," the well-known type of fjords parallel with the coast, which were once ice-covered. How they have been formed is not easy to determine, and however interesting the question may be, I cannot enter into it here.

Finally, a word about whether the two so similar continents once were united. In quite an analogous manner the two mountain chains incline in their extremity towards the east, and if a connection is to be sought it must be looked for, as has already often been pointed out, on the islands lying to the east,—the South Orkneys, South Sandwich islands, South Georgia, and Shag rocks. The last named are quite unknown geologically; what we know of the others is not much, and is not of a nature to point to any remarkable resemblance to the two continental territories. Both South Georgia and the South Orkneys seem to consist of strongly folded strata older than those we know in the continental cordilleras, and we know of no analogy in these to the volcanic arch of the South Sandwich islands.†

* Mr. S. S. Buckman, who has described the brachiopods, compares the temperature of the sea with that actually prevalent on the coast of Korea.

† So far as known, the South Sandwich group has not been visited by any scientific expedition since Bellingshausen's. I have recently received a large and

The hydrographical conditions, according to J. G. Andersson's investigations, also show that no submarine ridge connects these islands. In any case, of course, this does not exclude the possibility that they all owe their origin to the same folding zone, but if so it is probable that the connection between the territories is old and was demolished at an early period.

2. *Climate and Glaciation.*

The South Polar explorations of recent years have not been of greater importance in any department than in that of the study of the climate and glaciation of Antarctica. In the former we have learnt to know an entirely new type of climate prevalent in a whole continent, though here, as everywhere, at least in the border districts, with many local variations; in such a district, colder than the normal, was situated our Swedish winter station. As to the ice, we learnt to know hitherto unknown types, which are of the greatest interest in helping us to understand our own ice age, which was evidently characterized by the same features as the present Antarctic one, with an accumulation of ice on low stretches of land and at the sea-level.

The Antarctic climate, as was already known, is distinguished by its cold summers, beyond comparison the coldest in the world. At our station, 64° 22′ S. lat., the mean temperature for the three summer months was −2°·1 C. (28° Fahr.), consequently almost as cold as Stockholm in winter. The winter temperature, on the other hand, is in no wise of a record nature, the winter being considerably less cold than in northern continental tracts, such as Siberia, but colder or at least as cold as on the majority of Arctic islands and stretches of coast at the same distance from the north pole. The mean annual temperature of Antarctica is presumably the lowest in the world. Especially characteristic of the Antarctic regions are also the strong polar winds which prevail all the year round, consequently in the winter, too, and are of great importance in the distribution of the snow; yet elsewhere these cold winds do not seem to attain to such a record force as at our winter station.

The ice is what characterizes the Antarctic landscape above all; nowhere else on Earth is the land so covered with ice as here. In order to understand the origin and characteristic of these masses of ice, a few investigations that I carried out at our winter station may prove of interest; I will touch on them before passing on to a description of the different types of ice. One of them deals with the temperature of the ice. The island on which our station was situated is covered for the greater part by an even, dome-shaped mass of ice, which stretches out to sea on every side. It received the name of Snow hill from James Ross. Here, for a year and a half, I carried out a regular series of temperature

interesting series of rock specimens from these islands through Captain C. A. Larsen. All the specimens consist of basalts, but belonging to very different types: exhalations of volcanic gases were noted during Larsen's visit.

observations, the results of which were reduced to sea-level and are given in the appended diagram. From this it may be gathered that the inland ice, to which this form of ice exactly corresponds at a depth of, for instance, a metre, is about 3° Fahr. warmer in winter than a layer of earth at the same depth, while in summer it is no less than 6° Fahr. colder. The same is the case at a depth of half a metre. At the surface itself the differences of temperature are of course still greater; the earth in summer often rises to 30° C. (86° Fahr.), while the ice always remains considerably below the freezing-point. In the annual average this is somewhat equalized, but still the ice remains on the whole markedly colder than the snowless land. This temperature series, which, as far as I know, has no analogy in any other tract of glacial accumulation, is

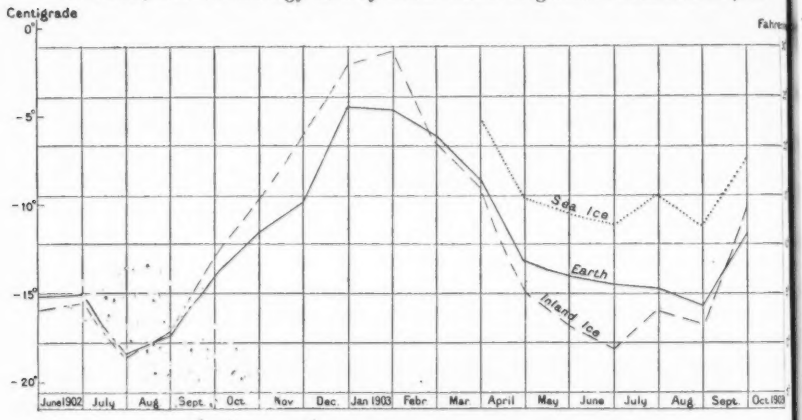
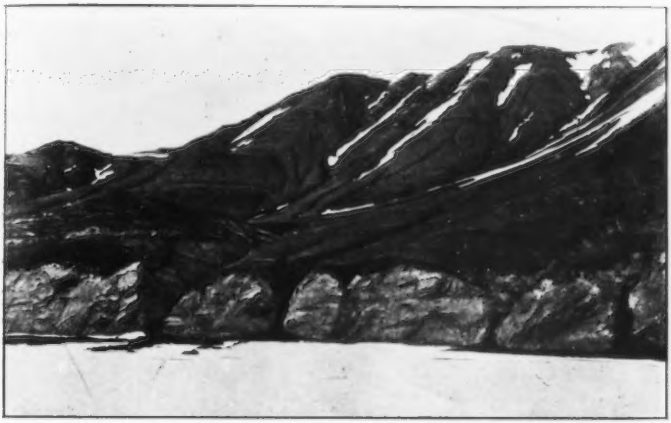


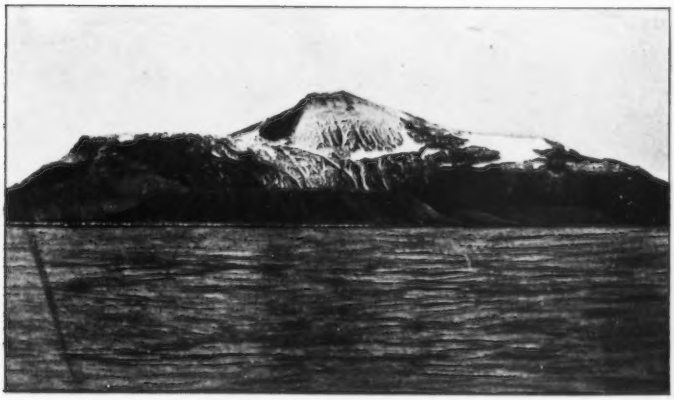
Diagram of Temperature at Snow Hill, at a depth of 1·0 Metre. June, 1902—Oct., 1903.

interesting in several respects. It gives us an indication of what radical changes the climate of a district may undergo when a glaciation of the land sets in, and in like manner it shows what great heat is required to melt the inland ice, and also why, once this melting has commenced, it must continue with ever-increasing rapidity. These questions are of weight in determining the state of things during our own ice age. For a comparison with the temperature of the sea-ice, we can only make use of a short series of observations; in winter, as was to be expected, the sea-ice is warmer than both the land-ice and the snowless land.

The other investigation was concerned with the accumulation and ablation of the ice at different periods in the year. At absolutely free spots upon the ice plateau, about 350 feet above sea-level, I had placed a number of bamboo sticks, whose height was regularly measured throughout the time we were there. The result is of interest in also showing the absolute dissimilarity with the conditions in the North Polar

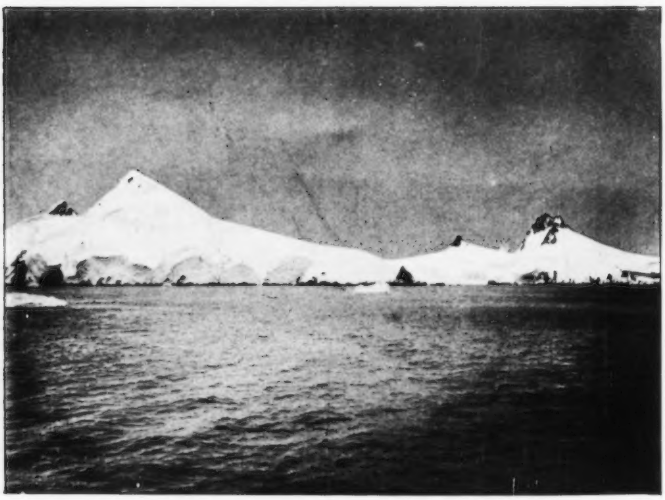


PART OF THE COAST OF SNOW HILL ISLAND. CRETACEOUS SANDSTONE, THE STEEP CLIFF FORMED BY ABRASION.



PAULET ISLAND, AN EXTINCT VOLCANO.

THE GREAT SNOW HILL GLACIER, SEEN FROM THE NORTH.



LIÈGE ISLAND AND MOUNT ALLO. ICE-FOOT GLACIER ALONG THE COAST.

regions. During the winter of 1902 the ice regularly lost in height every month about $\frac{3}{4}$ centimetre ($\frac{1}{3}$ inch). During spring and early summer there collected every month a layer of *névé* ice of an average thickness of 3 centimetres ($\frac{3}{4}$ inch), and during each of the two summer months, January and February, the increase amounted to no less than 7 centimetres (nearly 2 inches). Thus there was a considerable collection of snow during the summer; a uniform position or slight ablation in winter. The explanation of this can, of course, only be sought in the storms, which in summer are weaker, and therefore permit of the accumulation of snow. During our second winter, which was considerably calmer than the first, the surface of the ice was practically invariable.

In what I have just stated there seems to me to lie an explanation of the ice conditions in the Antarctic regions. A really typical inland ice, covering a widespread region without reference to the shape of the ground, was not found by me anywhere in the neighbourhood of Graham Land, while other parts of the Antarctic region, as we know, are quite covered up. The high rocky mass of the mainland reveals a glaciation of an Alpine type, though still more extensive than there; only the highest tops and steepest ridges jut out above the ice, which also fills deep hollows and sometimes forcibly reminds us of inland ice. I have called this the "Spitsbergen" type. In general, this form of ice extends with the same characteristic appearance right down to the level of the sea. At times, however, offshoots occur, corresponding to true valley glaciers, and when a lower-lying country stretches at the foot of a steep wall, the highland ice often rushes down in a sheer fall which expands at the foot into a true Piedmont glacier.

Besides these forms of ice, which also occur in the Arctic regions, there are others especially characteristic of the South Polar regions, and all distinguished by the fact that the ice has been formed by snow collected *near the level of the surface of the ocean*. Then we have to some extent what we might call "ice-foot glaciers," belts of beautifully stratified *névé* ice, which at the foot of high borders follow the land for long distances, resting either on a narrow strip of shore or on the sea-bottom. They have a pronounced terrace form, and dip towards the sea in a steep wall. This is a very usual type and more than any other characterizes the Antarctic landscape when compared with a northern region, such as Spitsbergen. Furthermore, we have ice-masses which in the form of a semicircular cupola quite cover low islands at times, so that it is impossible to decide directly that a nucleus of land is really present; this mass of ice, too, is bounded along the sea by a perpendicular wall. They quite correspond to inland ice in miniature; of such a kind, for instance, was the ice at our station, Snow hill, which I have just described. The third and most interesting of these types consists of the level icefield which, with an altitude of only 60 to 150 feet, is spread over extensive tracts of sea, which are probably always

shallow and somewhat protected from strong wave-motion. An icefield of this kind stretches along King Oscar coast south of 65° S. lat., where I studied it during a sleigh expedition; and to the same type belongs obviously the mighty barrier ice, so well known from the journeys of James Ross, Scott, and Shackleton. In 1905, at a discussion on Captain Scott's report on the results at the British Expedition, Mr. Lamplugh expressed the surmise that these ice-masses might correspond to those which during the Ice Age filled the North sea and the Irish sea, and also raised the question whether it could be possible, if a sea were frozen over or covered by pack-ice permanently, for a thick mass of ice to form gradually by the excess, under favourable conditions, of the winter snowfall over what would melt away in summer? I have always held a view, to which I gave expression in my very earliest publications, that contains an affirmative answer to this question, but with the difference that we have not to deal with a melting away, but with accumulations during the summer. What is to be seen of this ice is undoubtedly all formed from snow that had fallen on coast land, and is consequently not land ice at all. By this I do not mean to deny that the snow may have collected to some extent about a main body of glacier ice, but in those parts that are now afloat it was surely demolished by the melting from below; moreover, this theory does not seem to me necessary for the purpose of explaining the origin of such masses of ice. Why, under favourable conditions, should they not be able to form on the sea itself? The same view was afterwards expressed by Shackleton in his explanation of the barrier ice of Victoria Land. That the whole ice-mass consists of a tongue of land ice jutting out into the sea seems to me highly improbable, and, especially in the explored region which I know best, it is hard to imagine from where such a mighty ice-mass can come. In its form and appearance, it is true, this type of ice reminds one somewhat of the Piedmont glaciers, but differs from them in important respects—and, above all, in the matter of its origin. It has, therefore, seemed to me desirable that it should receive a new name, and I have consequently proposed the name "shelf ice," which indicates both its appearance and the character of the stretches of sea where it occurs.

The cause of the origin of these remarkable ice-formations is clearly to be sought in the Antarctic climate, which, under tolerably favourable circumstances, and above all at such sheltered spots where the ice transported by the storms can remain lying, as well as on such surfaces as are kept cool by a previous ice-covering, permits of ice collecting even during the summer and at the sea-level. The consequence is that, with the exception of the steepest dips, land free of ice rarely occurs in Antarctica. Now and again, however, we come across such ice-free tracts, as, for instance, on the Seymour islands, with their rich fossiliferous strata. I assume that their existence is connected with the strength of

the wind prevalent there, which is perhaps possibly stronger than in the surrounding parts.

But if, then, the Antarctic climate determines the glaciation, it may be said, conversely, that the latter to a great extent influences the former and gives it its peculiar character. We must now distinguish three main types of polar climate: a land climate, a sea climate, and a land-ice climate. The first occurs, for instance, in Eastern Siberia and Canada, where the snow-covering is thin in winter and quite disappears in summer. There the summer is warm and the winter very severe. To understand the character of a polar sea climate, we must bear in mind that in these parts the sea is covered with ice the whole year round, or for a greater part of the year. But even in these conditions, as we have seen, the sea-ice is warmer in winter than either the land-ice or land not covered by snow. In these regions, therefore, we may expect the mildest winters, whilst the summer will, of course, be colder than in continental regions. This is also the case; out on the polar sea or along the coast of isolated Arctic islands, *e.g.* Greenland and Spitsbergen, the winter temperature is not only milder than Siberia, but also in comparison with the Antarctic coast areas. These were the first to reveal definitely a true land-ice climate, of which before we had only had a vague conception from a few isolated observations taken in the interior of Greenland. Here the summer is the coldest on Earth, while the winter temperature lies between what prevails in the ice-free polar continental regions and that on the border of the ice-covered polar sea. That the immediate cause is to be sought in the conditions of temperature of the land-ice itself seems highly probable, judging from what has been adduced above.

We can now roughly sketch a picture of the type of nature which may be held to be specifically Antarctic, and the ultimate cause of which must doubtless be sought in the fact that in a continental territory in such a high degree of latitude both winter and summer are bound to be very cold. Consequently, great masses of ice collect there, which contribute to lower still more the summer temperature, while in exchange they make the cold of winter somewhat milder, and gradually wrap up all the land, so that only the steepest precipices and a few isolated islands in the region of the coast, which are exposed to the wind, are free from snow. A result of the extreme refrigeration of the land is, that there forms there a barometrical high-pressure zone with strong polar winds. The cold stormy summer only permits of the existence of a very inconsiderable vegetation of mosses and lichens, and therefore all land animals are almost completely lacking, in contrast to the sea, which, as in the northern polar regions, is the home of an especially abundant animal and plant life.

It is of special interest that all South Polar expeditions could state whether at an earlier period the ice had a still greater extension,

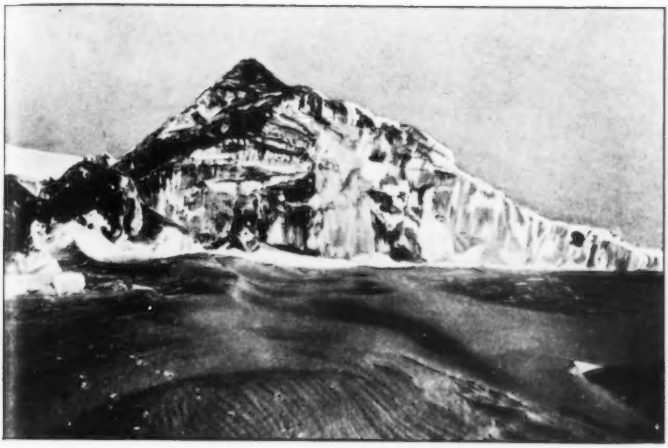
or at least thickness, than now. Our Swedish expedition made the observation in a number of places throughout the region we explored. As the climate is even now so extremely favourable to glaciation, it is hard to explain what was the cause of that "ice-period." That the climate was milder and moister than now I do not believe, for it would be impossible by that to explain the "ice-period" on sub-arctic islands, *e.g.* Kerguelen. Inasmuch as the extension of the ice is determined to such a degree by the strength of the winds, it is possible that a diminution of that strength may have given rise to a massing of ice, and this calmer period could be most easily explained by assuming a somewhat colder anti-cyclonic climate. At present it seems to be the general opinion that this more rigorous glaciation is quite recent, and that at this very moment the ice is rapidly retreating. But this does not apply to Snow Hill island and its environs. At the immediate border of the ice several deep valleys cut into the land, and from the sandstone rise steep towers and walls of basalt, which have been isolated by weathering that must have taken a long time, and which could certainly never have been crossed by the ice.

Even if we consider the existence of a period of still greater ice-extension as established, it by no means follows from this that all the land, including the steepest precipices, was then covered by ice, and it is, therefore, not impossible that some of the scanty vegetation which is still to be seen here may have survived that period in this particular region.

3. *A Few Notes on the History of the Names and Exploration of the Region.*

The man who is generally considered to be the first discoverer of a real Antarctic land is, as we know, the English merchant-service captain, William Smith. But it is not altogether certain; the statement that land south of South America was already seen by Dirck Gerritsz is certainly an obvious error, even if it is not altogether out of the question that some other mariner early in the seventeenth century came in touch with this coast, and I do not attach much importance to Heinrich Berghaus' oft-commented-on statement that these islands were visited as early as 1812 by American sealers. Still, the statement is remarkable that Sheffield, in his journey at the beginning of 1820, one year after Smith, heard of the South Shetlands from the crew of the Argentine brig, the *Espirito Santo*, though it is possible that the source of this ultimately goes back to communications from William Smith's journey; and there does not seem to be any reason to deprive the latter of the honour of being the discoverer of the last continent on the Earth.

There is more foundation for the discussion of who was the first discoverer of the Antarctic mainland. In this respect it would be of particular interest if we could obtain more exact information about



NORTH-WEST CORNER OF SNOW HILL GLACIER, SHOWING IRREGULAR STRATIFICATION.

CRETACEOUS SANDSTONE WITH BASALT DIKES UNCOVERED BY EROSION. SNOW HILL NEAR THE WINTER STATION.

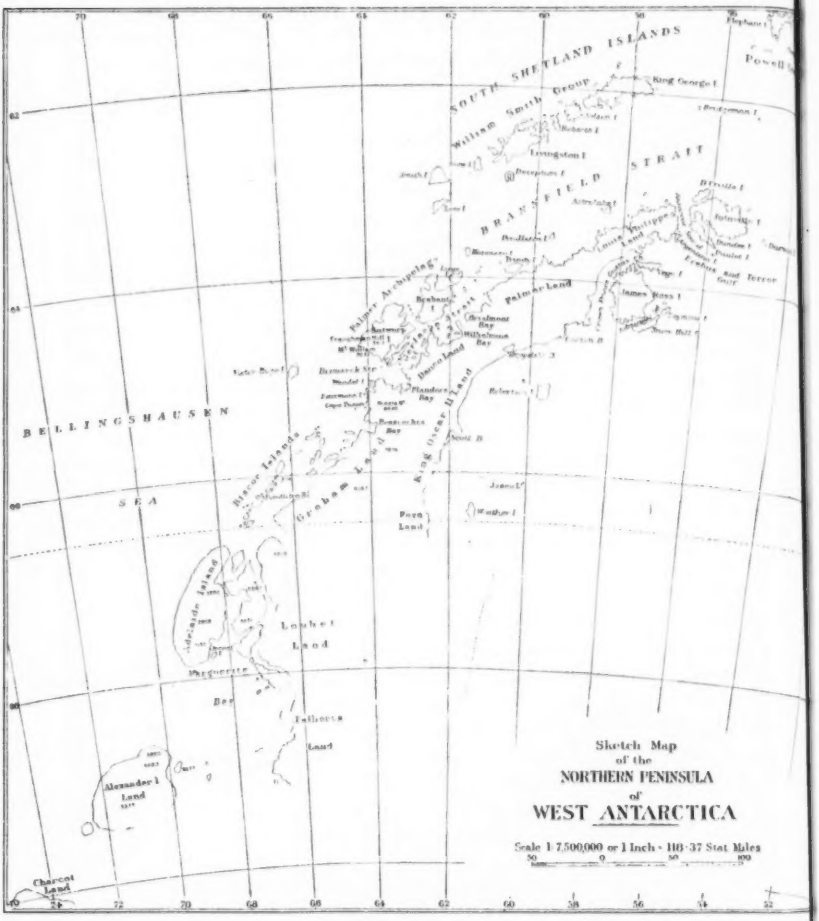
Edward Bransfield's journey of 1819–20, when possibly a part of the east coast was seen, and in case there are any documents preserved in British archives touching this expedition, their publication would be of great importance for judging of one of the most important questions in the history of geography. As things are, the American sealer, Nathaniel Palmer, is usually considered to have been the first to discover this tract of land (early in 1821). It is true that the discovery was made almost simultaneously from different quarters, and this first summer already furnishes three names referring to the mainland or its immediate environment, viz. Palmer Land, Trinity Land, and Alexander I. Land. Charcot has recently shown that this last is an island separated from the mainland, but the first two names both refer to about the same part of the north coast, and our expedition has shown that this coast forms a part of the actual mainland, which was not known for certain before.

Under these circumstances, it would obviously be most correct to make use of one of those names for this part of the Antarctic continent, giving the preference to the name that recalls the discoverer of the mainland. However, a much later denomination for a part of the same coast, Graham Land, has come into general use, in consequence of Biscoe's voyage. And if I do not here directly propose to substitute on every occasion the name that has priority for the one mentioned, it is only because I consider neither name suitable for the whole vast district that we are beginning to be acquainted with, and hence the point is not of real significance. It is striking how all discoveries in the Antarctic regions group themselves around the centres, the one south of Australia, the other south of South America, and for these I proposed, in 1905, and in agreement with the initiative of E. S. Balch, the names East and West Antarctica. That these territories must be bounded by the deep bights which we call Ross sea and Weddell sea, as also Prof. Penck has recently proposed, seems to me probable, and if the German South Polar Expedition, now starting, can show that these bights are connected by a sound, the delimitation would be all the more natural. The essential differences in topography and geological structure between the best-known parts of these territories I have already pointed out in the beginning of this communication. It will be of great interest to learn from the expeditions now at work how King Edward Land is situated with regard to these divisions.*

It is evident that we require a common appellation for the whole

* Since the above was written, Dr. Douglas Mawson has published in the June number of the *Geographical Journal* two very important alternative maps, intending to show the probable extension of the Antarctic continent. I hardly believe, however, that the view expressed in the larger principal map can be correct. Of course it is possible that a straight continuous coast-line connects Cape Adare with the Graham region, but judging from the experience in other parts of the world it is hardly probable, the geological structure of the regions being, as mentioned above, so completely different.

region south of South America, including such remote islands as the South Orkneys, etc. Even if one of the names, Palmer Land and Graham Land, should be preferred to the others, it should be confined to the now long-known tracts of land in the extreme north, and not be


SOUTH SHETLAND ISLANDS
Powell I
King George I
Bridgeman I
William Smith Group
Robert I
Livingston I
Deception I
Smith I
Low I
BRANSFIELD STRAIT
Bridle I
Dundee I
Dundee Is
Trinity Land
Joinville I
Duroch
Prince Gustav Channel
Foster and Terror Seas
Gulf
Palmer Land
James Ross I
Seymour I
Vega I
Snow Hill I
Erebus
Terror
Active
Mt Haddington
Mt Nansen
Mt Sabine
Mt Parry
Mt Melbourne
Mt Erebus
Mt Terror
Mt Bird
Mt Discovery
Mt Morning
Mt Lister
Mt Markham
Mt Kirkpatrick
Mt Hope
Mt Wilson
Mt Buckley
Mt Weaver
Mt Cleveland
Mt Sidley
Mt Rees
Mt Hayes
Mt Gardner
Mt Siple
Mt Waesche
Mt Murphy
Mt Rea
Mt Hunter
Mt Russell
Mt Gilbert
Mt Jackson
Mt Bowman
Mt Gaudry
Mt Dickerson
Mt Lucas
Mt Dana
Mt Peary
Mt Ross
Mt Wood
Mt Bruce
Mt Minto
Mt Sidley
Mt Rees
Mt Hayes
Mt Gardner
Mt Siple
Mt Waesche
Mt Murphy
Mt Rea
Mt Hunter
Mt Russell
Mt Gilbert
Mt Jackson
Mt Bowman
Mt Gaudry
Mt Dickerson
Mt Lucas
Mt Dana
Mt Peary
Mt Ross
Mt Wood
Mt Bruce
Mt Minto
Antarctic
Bay
Hope Bay
Duperrey I
Seymour I
Vega I
Snow Hill I
Erebus
Terror
Active
Mt Haddington
Mt Nansen
Mt Sabine
Mt Parry
Mt Melbourne
Mt Erebus
Mt Terror
Mt Bird
Mt Discovery
Mt Morning
Mt Lister
Mt Markham
Mt Kirkpatrick
Mt Hope
Mt Wilson
Mt Buckley
Mt Weaver
Mt Cleveland

west Antarctica, and the names Graham Land and Palmer Land, etc., can then be confined each to its own part of the coast. In recent times quite a number of other names have been introduced by various expeditions for different parts of the coast, without their being always necessary. Properly speaking, most of these ought to be deleted from the map, were it not that they have an historical value. If they are to be kept, we should give them a distinct limitation, and it is as an attempt in this direction that I have drawn the annexed little sketch-map. On it are also introduced a few other names that require a short explanation. Thus, the group of islands to the west of the Gerlache channel has hitherto often been called Palmer archipelago on the maps, presumably because it was believed that this was the most important part of the region Palmer discovered. But that is not the case. What was called Palmer Land on Laurie's map as far back as 1822 quite certainly corresponds to a part of the mainland, where the name should be retained. For this group of islands I have therefore proposed the name Belgica Archipelago, after the expedition which first mapped it. Furthermore, it is to be sincerely regretted that two such important discoverers' names as William Smith and Powell are not referred to or represented on only a small island. It is scarcely expedient to strike out the names South Shetland and South Orkneys on the map in order to substitute the names of their discoverers, but it is much to be desired that special names should be given to the two well-defined parts of which the former archipelago consists, and I have therefore proposed to call the western main group the William Smith group, and the eastern division, Elephant and Clarence islands, the Powell group.

As we know, all these groups of islands have, partly as a result of our Swedish expedition, become of great interest, owing to the present activity of the whale-hunters there. For scientific purposes much still remains to be done in these parts, where important results in several regions can be attained relatively easily. Only in connection with such investigation, and when it has been decided how this remarkable projecting peninsula is connected with the main mass of the continent, will it be advisable to decide definitely what names the different parts are to bear.

THE COUNTRY BETWEEN THE JUBA RIVER AND LAKE RUDOLF.

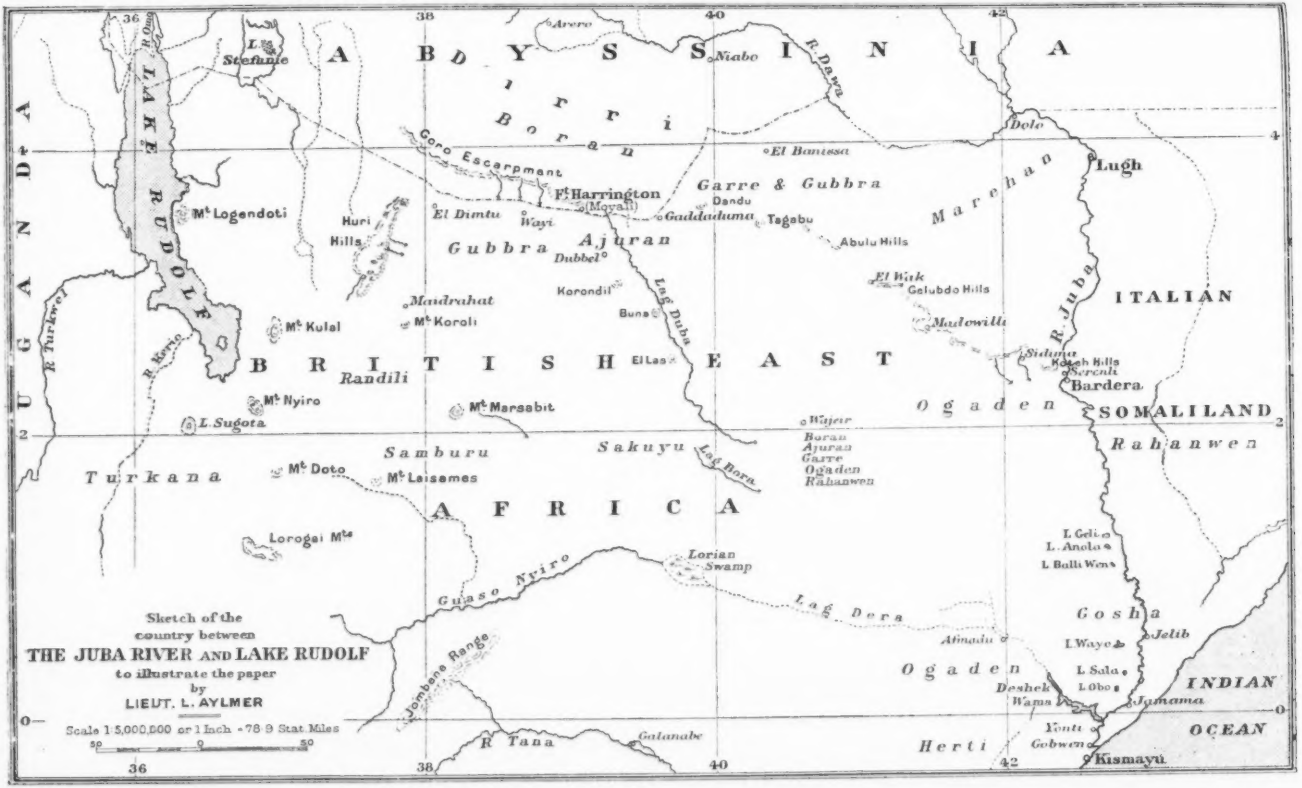
By Lieut. L. AYLMER.

Though Jubaland is a province of British East Africa, it is from a climatical, ethnological, and topographical point of view more similar to Somaliland, and I cannot do better than preface the following notes with a quotation from the official handbook of that country. Under the heading "Physical Geography" it says, "It is conjectured that at a, geologically,

recent age the whole of the littoral of the East Coast of Africa was submerged by the sea. A convulsion of nature then uplifted an enormous tract of country, the so-called 'Roof of Africa,' which runs between the 38th and 39th degrees of east longitude from Ankober almost due north and south to Massowa and Kilimanjaro respectively. In this upheaval volcanic action took a great part."

One great difference, however, exists between Somaliland and Jubaland. The former carries out the essential conditions of a desert laid down by Prof. Walther, namely, a region without external drainage, all of whose material, therefore, soluble and insoluble, can only be transported about within itself. But in the latter case the Juba river breaks the condition and flows into the sea, at the same time giving external drainage to a large area intersected with watercourses which in the wet season run into the Juba. Somaliland also possesses several ranges of maritime mountains, while in the latter country one can march from Kismayu near the mouth of the Juba river to El Las, a distance of about 300 miles, and nowhere can a hill of any sort be seen. Even El Las, Buna, and Korondil are but isolated specimens of harder rocks which have resisted the effects of erosion, and have thus been left standing above the surrounding plain. The Goro escarpment, 370 miles from the coast, and the Koteh hills near Bardera, 220 miles from the coast, are practically the nearest ranges to the sea in this country; for one cannot count the sandhills which form all along the coast of Jubaland and are but a few tens of feet in height.

Bardera, a distance of 200 miles up the Juba, is but 500 feet above the sea-level. The obvious conclusion to be drawn from this fact is that the country is marvellously suitable for irrigation if the waters of the Juba could be properly controlled instead of, as at present, running to waste into the lakes and swamps which abound along the lower reaches. As yet the population is not sufficiently thick to warrant any great expenditure; but the soil is rich, and with no other help but the scanty rainfall heavy crops are often obtained many miles from the river. Perhaps in the distant future this huge desert is destined to become a rich and prosperous grain-producing area. Like other rivers running through very level country, it is very winding and has probably changed considerably the position of its bed. Quite recently it has opened a new mouth into the sea near Gobwen; the alluvial nature of the soil and sandy coast-line lend themselves to rapid erosion. During the wet season the sea for several miles round the mouth of the river is coloured red by the detritus brought down from up-country. In some instances the soil worn away by the river seems to have been deposited in lowlying parts of the land, and thus the river is running between banks which are actually higher than the adjacent country. It would seem that the sea is either still withdrawing or the shore-line silting up, for even in the memory of living man ships anchored in the old harbour of Kismayu where now even at high water the smallest boat could hardly float among the mangroves which have grown where once was deep water. Right up


Sketch of the
country between
THE JUBA RIVER AND LAKE RUDOLF
to illustrate the paper
by
LIEUT. L. AYLMER
Scale 1:5,000,000 or 1 Inch = 78·9 Stat. Miles
50 0 50
ABYSSINIA
UGANDA
BRITISH EAST AFRICA
ITALIAN SOMALILAND
INDIAN OCEAN
LAKE RUDOLF
L. Stefanie
R. Omo
R. Kerio
R. Turkwel
R. Juba
R. Dawa
Arero
Miabo
Dolo
El Buntessa
Lugh
Coro Escarpment
Ft Harrington
Moyale
Garre & Gubbra
Dandu
Gaddaduma
Tagabu
Marehan
Abulu Hills
El Dimtu
Wayi
Huri Hills
Mt Logendoti
Gubbra Ajuran
Dubbel
El Wak
Gelubdo Hills
Korondil
Buna
Lag Dubia
Madowilla
Mandrahat
Mt Koroli
Mt Kulal
Randili
El Las
Sidima
Kotah Hills
Bardera
Mt Nyiro
Mt Marsabit
L. Sugota
Ogaden
Rahanwen
Wajer
Boran
Ajuran
Garre
Ogaden
Rahanwen
Samburu
Sakuyu
Lag Bora
Turkana
Mt Doto
Mt Laisames
Lorogai Mts
Lorian Swamp
Guaso Nyiro
Lag Dera
L. Geli
L. Anole
L. Bulla Wens
Goshа
Jelib
Afmadu
L. Waye
L. Sala
L. Obo
Deshek
Wama
Jumama
Jombene Range
R. Tana
Galanabe
Herti
Yonti
Gobwen
Kismayu

to the Anglo-Abyssinian border are to be found coral rock and marine deposits of recent age. Prof. Walther refuses to consider that deserts are in general ancient sea-beds, but there would seem to be no doubt that at any rate it was the case here.

North of Bardera the Juba is joined by the river Dawa, which, like the rivers Shebeli and Fafan in the north-east and the Omo to the west, has its source in the Abyssinian highlands. Travelling westwards from the Juba and the Dawa, there is not a single river of permanently running water till the Omo and Lake Rudolf are reached.

This vast district of some 80,000 square miles is lying absolutely wasted, from the point of view of civilized man, entirely owing to the lack of water. It is practically an enormous bush-covered plain, for only on approaching Rudolf in the west and Abyssinia in the north is the general flatness of the country broken by isolated rocky hills and lava-strewn ridges. Generally speaking, the surface of the ground is covered with stones, most of which are quartz; there are, however, large stretches of rich alluvial soil formed by the detritus carried down from the hills by the action of the water during the rains. These tracts of alluvial soil increase in size and frequency towards the coast, and if it ever proves possible to irrigate them, they would prove extraordinarily fertile. Even now some of the more enterprising of the nomads who roam the country obtain an occasional crop of maize by sowing either before the scanty rains or immediately afterwards in a hollow where the water may stand for a short time after the dry season has commenced. Along the banks of the Juba it would be possible with irrigation to reap three or four crops a year, such is the rapidity with which suitable crops reach maturity.

The inhabitants of the country own camels and cattle, goats, sheep, and donkeys, and are, of course, entirely dependent on the state of their herds for their very existence. Their herds, again, are dependent on the water-supply. Besides the rains, which usually, though not always, fall twice a year in the greater and the lesser rains, water is procured from wells, with which the country is fairly well supplied. The natives do not seem to recognize any difference between wells and springs, all local supplies of water coming under the former denomination, though actually they may be divided into several classes—

1. Springs, very rare, usually in the bed of ravines, as at Kurao, near Bardera; often brackish, as at Mydrahat and Koroli, between Marsabit and Rudolf, which issue from the foot of lava ridges.

2. Wells dug in stream beds only a few feet deep, and sometimes when empty take a day to fill up again. This form of water-supply is seen at Sidima, and also in the watercourses which run into the Guaso Nyiro south of Marsabit.

3. Wells natural or dug at the foot of hills, which are sometimes permanent, as at Gaddaduma and Dabbel, and sometimes not, as at El Las, Korondil.

4. Cavities in rocks which are like natural tanks and sometimes hold thousands of gallons; but to last any length of time they must be inaccessible to wild animals, especially elephants, and have a small aperture to prevent excessive evaporation.

5. Deep wells dug apparently haphazard, but which seem to tap underground streams, and which yield an abundant and inexhaustible supply of water. The wells at Wajeir and El Wak are the only two instances in this country, though there are several places in Northern Somaliland, notably Burao and Wadamago.

The above list comprises every form of water-supply in the dry weather, and undoubtedly the most important is the last mentioned.

El Wak, which means "the Wells of God," are very numerous, but are so scattered that it is almost impossible to count them; there are probably over a hundred, but many are filled up and so not in use. They are not dug directly down to the water, but incline one way or another, and also have passages underground branching off to different water-supplies. At one well were no less than twenty men standing one above the other, and passing the water in giraffe-hide buckets to be emptied into a tank at the top. The full bucket is passed up with one hand, while the empty returns by the other; regularity is kept by the time of a quaint chant, which sounds most weird coming from the dark depth of the well. The water is found underground in a sort of light bluish clay, and is said never to have been known to show signs of decreasing in quantity. In the neighbourhood is coral limestone, gypsum, and other deposits, probably similar to the geological formation in Northern Somaliland.

The wells at Wajeir are quite different. Nearly as numerous as those of El Wak, they are cut straight down through solid rock, and are almost all similarly shaped, for in each case the mouth is 36 to 40 inches in diameter, and the water is 22 to 28 feet below the surface. The rock seems to be a kind of limestone, and though not very hard, argues in favour of a far more industrious race having cut them than any of the present inhabitants. Some old men said that the wells were excavated by the Warday, a tribe of Galla origin long since conquered and assimilated by the Somalis; others declared that they were the work of a tribe called Mathanli, who were conquered by the Gallas, and of whom all trace has now disappeared. When questioned about the makers of the wells of El Wak, they profess entire ignorance, and merely point towards the sky and say, "Wak" (God).

Around the wells at Wajeir are many curious piles of igneous rocks; very similar ones are also to be seen near the wells or springs at the southern end of the Huri hills. The whole surface of the ground is also covered with these rocks, and it may be that generations of the different races who have inhabited these deserts have collected them into piles to make the paths near the watering-places easier for their flocks and

herds to pass over; though it is more likely to be the result of explosions following or accompanying the original volcanic action. The wells at Wajeir follow a line roughly from north-west to south-east, but there are groups of wells, too, some miles away on either side of the general line. Both at El Wak and Wajeir there is no indication given in any way by the look of the country, except, of course, the numerous cattle tracks, that a well is at hand; they seem to be situated haphazard anywhere in the bush, just as likely to be on high ground as low; but, as a matter of fact, the natives claim that some of their old men know exactly where to strike for water.

At Sidima the water is so strongly impregnated with sulphuretted hydrogen that it is most unpleasant to the taste, and after a few days' storage it is well-nigh impossible to drink it at all, and the smell is awful, but, curiously, it seems to have no ill effects except as a slight aperient. The water of El Wak, however, though sweet to drink except for a slightly oily taste, has the most violent effects to those unaccustomed to it, causing both head and stomach aches, the chemicals contained in the water being probably too strong for human consumption. At Wajeir the water has the very slightest chemical taste, and is very wholesome as a blood purifier and febrifuge.

From the Juba westwards the whole country is covered with bush of many kinds. The nature of the bush in a district is often indicated by the native name; for instance, Derkenli, abounding in derken trees or the candelabra euphorbia, and many names composed of "yag," the baobab or "garras," a sort of wild olive. There are many species of gum-bearing trees whose product has a marketable value; from others the natives obtain sweet-smelling resin (or myrrh), and there are several kinds of sweet-smelling woods.

Soon after crossing the Moyali-Wajeir road, however, the ground begins to be strewn with lava rocks, which increase in quantity as the Huri range is approached, and thence right to Rudolf and further south than Marsabit, the formation consists of nothing else but miles and miles of sterile lava ridges, divided occasionally by hard stony stretches of country and salt-encrusted flats. The barrenness of the country is only accentuated by an occasional clump of acacia trees, stunted and gnarled by their struggle for existence against the stony nature of the soil, the fierce rays of the sun, and the hot winds which blow regularly day and night across the desert and form one of the natural phenomena of the country.

This wind seems to be caused by the movements of the air currents against the high hills of Huri and Marsabit, and, to once more quote Prof. Walther, is the determining factor in desert sculpture, and whose action he calls "deflation," for it removes the weathered rock material, whether soluble or insoluble, as soon as it appears at the surface, thus constantly exposing fresh rock to the erosive forces. The higher slopes of the former range are covered with luxuriant long grass, but no trees or

water. Near the summit of Marsabit, however, is a beautiful crater lake, and the crest and western slopes are covered with thick forest, which of course has a most beneficial effect on the rainfall.

The population of this huge piece of country is very scanty when judged by the civilized standard of inhabitants to the square mile. But it must not be forgotten that for many years their herds have been ravaged by "rinderpest" and pleuro-pneumonia, and as the means of nourishment and comfort have decreased, so has the birthrate. Added to this, the constant state of warfare in which many of the tribes live is quite sufficient to prevent the increase which might be expected from a prolific race.

Round Marsabit live the Samburu and Randili. The former are a branch of the Masai, and resemble them in looks and language, and are cattle-owners. The latter resemble them in looks, but speak a dialect of Somali, and are camel-owners; they claim to be a branch of the Somali race.

Between the Huri hills and Wajeir the Gubbra and Sankuyu graze their camels. The former claim to be a branch of the Somali race, and the latter are of Galla descent; they both speak the Galla language.

Along the Abyssinian border the inhabitants are mostly Boran, who are of the Galla race and language. Intermingled with them are to be found many Ajuran Somalis, of the Hawiyah division, and Gurreh, another large division of the Somali race. The latter, together with some of the Gubbra, have their headquarters at El Wak.

These five tribes, Boran, Sakuyu, Gubbra, Ajuran, and Gurreh, are bound by treaties of friendship, and to some extent intermarry and share their villages, even though the Gallas still remain pagans, while their Somali neighbours are Muhammadans.

Living in widely scattered localities are the Wata, who gain a precarious livelihood by hunting. They correspond to the Waboni of the Somalis and the Ndorobo of the Masai. An ingenious French author has discovered a similarity between their name and that of the Wayatu mentioned as the objective of many raids by some of the Pharaohs. The Wata are found in Abyssinia, and certainly seem to be the original inhabitants of the land.

Along the banks of the Dawa and Juba rivers are members of various tribes, chiefly ex-slaves of the Somalis, who cultivate the banks of the river, and, in fact, are the only agriculturists in the country.

It has always been assumed, if not proved, that some of the present tribes of East Africa, and for that matter of Abyssinia and Arabia, have migrated to their present positions at a comparatively recent period. It is a further link in the chain of evidence when it is found the extension and movement of tribes is actually going on at the present moment in the country which is the subject of this article. First of all, we have the Gallas claiming to have been in complete possession of the country

lying between Abyssinia and the Indian ocean—a claim upheld by the nomenclature of the country, and by the statement of the Somalis, their conquerors, among whom the remnants of them live as slaves, except on the Tana river, where a small body have succeeded in retaining their independence. About 800 or 900 years ago the Horn of Africa was politically and commercially more closely related to Arabia than it is at the present day, and it was at that date that the Somali race was first formed by numerous emigrants from Southern Arabia intermingling with, intermarrying with, and proselytizing the indigenous tribes, who were probably of Galla stock. Since then they have extended in all directions along the lines of least resistance.

It is less than a hundred years ago that the first Somalis crossed the Juba river; now the Ajuran and Gurreh are firmly established at and beyond Wajeir and El Wak, and the Ogaden and Herti along the Juba and the coast. The means employed are as far as possible, in the early stages, peaceful, and fighting only takes place when the new-comers feel themselves strong enough to overcome by force the friends whom they have deceived by false promises of allegiance. It is only during the last few years that parties of Ogaden and Rahanwen have reached Wajeir, forced on by the necessity for fresh grazing and water for their ever-increasing herds, whose numbers are only limited by an occasional epidemic.

The Masai, who themselves migrated from elsewhere in times past, also formed a factor in the partition, and it is possible that the Somalis might have reached the highlands of East Africa if they had not been held in check by that tribe. Their warriors more than decimated by small-pox, their herds by cattle disease, and their warlike qualities eradicated by peaceful administration, the Masai have entirely fallen from their former greatness. Not many years ago their raiding-parties penetrated to Mombasa and Witu, and about 1876 they not only raided but occupied for a year the country stretching from the Guaso Nyiro up to Wayi and Korondil, and were only driven back by mounted reinforcements which the Gallas brought down from the highlands of Dirri.

Now that the country is gradually coming under effective British administration, expansions of the old kind will probably cease, and if steps can be taken to increase the water-supply by the sinking of wells and cutting of canals, the country will soon be supporting ever-increasing numbers of contented people and their cattle, who, though at present nomads, may eventually under more certain conditions of life evolve into agriculturists.

Thus Britain may some day be able to claim as an achievement, not only the change of warlike savages into peaceful subjects, but barren deserts into rich and fertile provinces.

FOURTH REPORT OF PROGRESS IN THE INVESTIGATION OF RIVERS.*

THE EXE AND ITS TRIBUTARIES.

The reading of the gauges on the Exe and Creedy has been continued, and Mr. Gray has kindly furnished another year's observations on the gauge on the Culm. The velocity-course at Exeter quay, which was marked out in 1907, and of which a cross-section was given in the Third Report (*Geographical Journal*, 1910, p. 583, Fig. 1), has been re-examined by Mr. Mackenzie, with the result of showing that there has been practically no change in it.

The gauge-readings have provided some data for the tracing of flood-water down the river from Exebridge near Dulverton to Exeter, a matter which is dealt with by Mr. Mackenzie in his note herewith appended.

The readings have now furnished a daily record of the level of the river for a period of three and a half years. On the completion of the fourth year they will be discontinued, but the Committee hopes that it will be possible to make further observations on the velocity-course at Exeter quay, for the purpose of establishing a closer connection between river-level and discharge than is at present possible.

As regards the matter carried in suspension or solution, Mr. Thomas Moulding, the Exeter City Surveyor, has been so kind as to furnish the following information respecting the dredging of the channel near the bathing place at Exeter and a short distance above a weir. One of the objects of the dredging has been to keep the channel year by year at the same depth. To attain this object all the material which had accumulated by rolling along the bottom had to be removed yearly, inasmuch as none of it could pass the weir. Mr. Moulding remarks that there is no doubt that the dredging has been going on from twenty to twenty-five years, but that his own records go back only to 1904.

The dredgings for		1904	were	1690	cubic yards
,,	,,	1905	,,	1576	,,
,,	,,	1906	,,	1388	,,
,,	,,	1907	,,	892	,,
,,	,,	1908	,,	892	,,
,,	,,	1909	,,	1423	,,
,,	,,	1910	,,	210	,,
Total in seven years was				8071	,,

The average amount dredged annually during the last seven years amounts to 1153 cubic yards, and this presumably represents the amount of material rolled along the bottom of the river.

The dredgings consist of about 50 per cent. of large stones, say 3 inches in diameter, 40 per cent. of stones varying from 2 inches diameter to the size of a pea, and about 10 per cent. varying from the size of a pea to fine sand.

The measurements of the areas occupied in the Exe basin by the various geological formations which are likely to differ in permeability, or to affect in other ways the character of the river, have been completed by Mr. Elton. The outcrops were enlarged from the Old Series 1-inch geological maps. A preliminary note on the work appeared in the *Geographical Journal* for 1908, p. 312. The measurements of inter-contour areas by Mr. Carter, so far as they were completed before his illness, are also appended.

† Research Department, June 15, 1911.

Measurements of the Areas occupied by Various Geological Formations in the Exe Basin.

By E. F. ELTON.

The areas given in the following table of the upper Exe, the Culm, and the Creedy are those of such parts of their basins as drain into them above the gauges at Brampford Speke, Silverton, and Pynes bridge. The intergauge area is that which drains into these streams between the gauges mentioned and the gauge on the Exeter quay. The sum of the four areas is the area of the Exe basin above tidal waters.

Exe Basin above Tidal Waters.

Basin of	Devonian.	Culm measures.	New Red Sandstone.	Lime stone.	Upper Greensand.	New Red Marl.	Igneous.	Alluvial.	Total in acres.
	acres.	acres.	acres.	acres.	acres.	acres.	acres.	acres.	acres.
Upper Exe	82,684·68	50,600·58	16,826·82	311·19	—	—	461·01	2732·64	153,616·92
Creedy ...	—	44,986·29	19,119·78	—	—	—	652·95	1811·76	66,570·78
Culm ...	—	2,917·86	34,852·23	419·46	17,375·40	6171·24	95·70	3691·23	65,523·12
Intergauge	—	3,879·60	3,496·80	—	—	—	346·47	1927·05	9,649·92
	82,684·68	102,384·33	74,295·63	730·65	17,375·40	6171·24	1556·13	10,162·68	295,360·74

Total area of basin, 295,360·74 acres = 461·50[115625] square miles.

Some account of the steps taken to obtain the above figures may be desirable, to give an idea of the degree of accuracy that may be expected from them.

It was found that the Exe basin occupied the whole or part of 113 sheets of the 6-inch map, and the boundary of the several areas required was marked on these sheets. As a rule the surface and other features of these maps left very little room for doubt as to the position of the boundary; but where it seemed uncertain, with the assistance of Mr. H. O. Beckitt, I determined its position on the spot. For this purpose we put upwards of 70 miles of boundary on to the 6-inch sheets in the field. The sheets were then coloured in Jermyn Street to show the geology of the region.

To measure these areas a Stanley and Amsler's patent compensating planimeter was provided. This instrument has the great advantage over the ordinary planimeter that it can be adjusted so as to compensate for the shrinking or stretching of the map, which saves the calculation otherwise necessary for each sheet measured. As sold, the planimeter is arranged to measure maps of many different scales; but I found it convenient to have it further engraved so as to read areas from the 6-inch map in the largest possible unit, *i.e.* in units of 300 acres. As the area of a sheet is known, it was possible both to check the work and to estimate the accuracy of the planimeter as each sheet was completed, and it was evident that the compensation for shrinkage and stretching was remarkably successful.

These errors in the length and breadth of each sheet have to be known in percentages of the proper dimensions, and I therefore had a rule made showing on one edge a length of 12 inches, and on the other edge a length of 18 inches, each divided into tenths and hundredths of the entire length, so that the percentage of error could be read directly. In ordering a rule of this sort it is important to remember that it must be longer than 18 inches, say 19·8 inches, since maps stretch as well as shrink.

The first actual measurement made is of the length and breadth of the sheet.

The errors are combined and the necessary adjustment made in the planimeter. I then measured each area into which the sheet was divided from three up to seven times, or even oftener, according to its difficulty, and took the mean of the measurements. When this had been done for all sections of a sheet, the sum of the measurements obtained ought, of course, to have been 6 square miles. There was generally some small error, which I distributed over the sections of the sheet in proportion to their area.

The planimeter and rule with the modifications described above have been so accurate and convenient in use that similar instruments have been provided for the Medway basin, and Mr. Dann has, I understand, adopted the same method of treating the errors of each sheet.

The boundary of the basin, which was first obtained upon the 6-inch maps, I subsequently transferred to the 1-inch sheets for the use of those who undertake the measuring of the areas between the different contour-lines.

Measurements of Inter-Contour Areas in Part of the Exe Basin.

By G. E. L. CARTER.

	Sheet 294 (Dulverton).	Sheet 311 (Wellington).	Sheet 324 (Okehampton).	Sheet 310 (Tiverton).
ft.	acres.	acres.	acres.	acres.
Above 1500	226·1326	—	—	—
From 1250–1500 ...	6,064·7389	—	—	—
,, 1000–1250 ...	26,921·7428	—	—	—
,, 800–1000 ...	20,322·0556	7,089·4566	258·2028	5,482·235
,, 600–800 ...	11,162·1879	11,207·7591	4,749·9399	28,858·844
,, 400–600 ...	6,046·8077	10,174·9245	7,448·1600	31,518·365
,, 200–400 ... } Below 200 ... ... }	338·7009	3,650·0172	4,453·9996	35,037·051 / 3,402·766
	71,083·37	32,122·16	16,910·30	104,299·62

Parts of three more 1-inch sheets remain to be dealt with.

Note on the Progress of the Work on the Exe.

By N. F. MACKENZIE.

I have drawn up discharge-diagrams of the Brampford Speke gauge for the years 1907–1910 inclusive, and these are ready for the rainfall record.

For the Exeter Quay gauge we have four years of gauge-readings, but the data necessary for converting these into volumes of water are not yet complete. I visited Exeter in April last, and spent three days on the river. I was able to get satisfactory measurements of three separate discharges, but unfortunately I did not hit off a flood, and we require more measured discharges before a discharge-curve can be drawn up for this gauge.

I took careful cross-sections of the Exeter discharge-site, and found that there has been no alteration in the section of the river; my soundings differ by inches from those taken four years ago, but the area of the cross-section is practically the same as before.

I paid a flying visit to Brampford Speke, and though I had no opportunity of taking a measured cross-section, so far as I could judge the river was much the same as when our cross-sections were taken. The river was rather low, though there had been a good deal of rain and snow, and I was struck by what other observers have also noted, viz. the marked absence of suspended

matter; the water was so clear that every stone on the bed could be seen distinctly.

I have compiled a table tracing the passage of the Exe floods down the valley. This is not very complete, as it frequently happens that moderately high floods in the upper reaches have so little effect on the Exeter gauge that hourly gauge-readings are not recorded. Again, where a flood lasts for two days we may have at Exebridge hourly gauge-readings for the first day, and at Exeter hourly readings for the second day, and these cannot be compared. The table exhibits all flood-records which can be compared.

EXE RIVER FLOODS.

Date.	High water.			Brampford Speke.		Time of Passage. Hours.	
	Exebridge.	Brampford Speke.	Exeter Quay.	Gauge.	Discharge.	Exebridge to Brampford Speke.	Brampford Speke to Exeter.
				ft. ins.	Cusecs.		
5.12.07	8 a.m.	10 a.m.	2 p.m.	7 0	2960	2	4
1.9.08	3 p.m.	7.30 p.m.	—	4 4	1566	4·5	—
31.12.08	6 p.m.	10 p.m.	—	4 4	1566	4	—
9.3.09	—	4 a.m.	9 a.m.	6 1	2414	—	5
16.10.09	3 a.m.	9 a.m.	—	7 8	3409	6	—
3.12.09	2 a.m.	9 a.m.	noon	8 0	3635	7	3
24.1.10	—	7.45 a.m.	11 a.m.	7 10	3522	—	3·25
13.10.10	—	11 a.m.	3 p.m.	7 9	3465	—	4
1.11.10	noon	6.30 p.m.	—	8 2	3765	6·5	—
13.12.10	10 a.m.	3.30 p.m.	5 p.m.	6 10	2860	5·5	1·5
16.12.10	—	1.30 p.m.	4 p.m.	7 11	3578	—	2·5
25.2.11	1 p.m.	5.15 p.m.	—	5 2	1978	4·25	—
28.2.11	2 p.m.	6.15 p.m.	—	6 4	2563	4·25	—
					Average	4·9	3·3

Exebridge to Brampford Speke = 22·5 miles.
Brampford Speke to Exeter = 6 miles.

There is one interesting point about these records: there is at least an indication that the crest-wave of high floods takes longer to pass down the valley than the crest-wave of moderate floods. In the upper portion of the river the channel is deep, and floods do not spill over the banks, but in the lower reaches the river has a broad shallow section, and floods spread out laterally to a considerable distance.

A moderate flood is contained in the actual channel of the river and travels quickly, while a high flood spreads out laterally in the lower reaches and the velocity of the flood-crest is reduced. This is merely a guess at the cause of the comparatively low velocity of high floods, and it will be of interest to investigate this point when we have more complete flood-records. So far as our present records show, moderate floods do travel more quickly than high floods, which is the opposite of what one would naturally expect to find.

There is considerable doubt as to the time of high water at Exebridge during the flood of 5.12.07. The hourly record begins at 8 a.m., and the observer notes this as the time of high water. Probably, however, the maximum gauge occurred first, some hours earlier, than 8 a.m., and then the gauge remained steady.

The interval between the time at which there is a marked fall in the gauge-reading at Exebridge and at Bramford Speke is about $5\frac{1}{2}$ hours.

It is difficult to believe that the crest-wave of a flood on the Exe travelled $22\frac{1}{2}$ miles in two hours.

THE SEVERN.

The limits of the Severn basin have been drawn, so far as is possible, from inspection of the Ordnance maps, but there remain about 113 miles of water-parting of indefinite character which cannot be so traced. Revision is being made by Dr. Owens for the examination of these doubtful parts upon the ground. With respect to the suspended and dissolved matter in the Severn water, Dr. G. H. Woollat reports, "As foreshadowed in my last report, we have been paying some attention to the matter of difference in composition at varying depths, and our results are not, just this minute, such as we should care to publish, mainly owing, I think, to the small amount of time we have been able to spend at this work. I think, with your permission, we had better leave this over for the immediate present, and trust to have some information for you when the next report becomes due."

The daily records of rainfall at more than eighty rain-gauges within or near the Severn basin during the years 1881 to 1889 have been furnished by the British Rainfall Organization, the expenses of the labour involved having been defrayed by the Committee out of their grant. The preparation of a rainfall curve from these records has been further considered by Dr. Owens. The method which he proposes to adopt is discussed in the appended note, which forms a continuation of the discussion initiated in the Third Report of Progress (*Geographical Journal*, 1910, p. 592).

Rainfall in the Severn Basin.

By Dr. J. S. OWENS.

In the report of last year, the methods which might be used to obtain the daily rainfall over the Severn basin were discussed. Not having at that time the rainfall-records, it was suggested that the best method for treating the data would probably be to divide up the basin into small areas of as nearly as possible uniform rainfall, using for this purpose the rainfall-records available, and also taking geographical considerations into account. The average fall for each area was then to be taken from the readings of the gauges enclosed, and thus the total fall on each small area could be obtained. The sum of all these figures would give the total fall for the basin.

Since suggesting this method, however, I have received all the rainfall-records available for the Severn basin from 1882 to 1889 (inclusive), and a careful study of these soon showed that it would be impracticable to obtain the daily rainfall with any accuracy by this method. Several difficulties had to be dealt with:—

1. The gauges available were scattered very irregularly over the basin, large areas being without any, while in other parts a number would be concentrated within a small radius.

2. The gauge-readings available varied from year to year, so that in one year perhaps a whole group would be absent, or several out of a group. In fact, very few gauges read continuously for the whole period under consideration.

3. Gauges situated in close proximity very often gave quite different

readings—that is, gauges which would be expected to give practically similar readings. This made it difficult to map out areas of uniform fall, as, for example, when a high-reading gauge occurred in a group of low-reading gauges.

It was also found that no data were available to fix the boundaries of the secondary areas, and that each year would require a different arrangement of the areas, owing to the gauges for one year not being the same as for another.

After careful consideration the following method was finally adopted. All the gauges available were marked on the ¼-inch map of the basin by the aid of a gazetteer, and by reference to the 6-inch Ordnance sheets, each gauge being given a number to correspond with a similar one on its record-sheets. In this way eighty-three gauges were marked in, and it was found, as stated above, that they tended to group themselves round certain points, leaving large areas of the basin unrepresented, except perhaps by a single gauge. The boundary of the river-basin was then transferred to the ¼-inch from the ½-inch map on which Dr. Strahan had marked most of the water-parting.

The next step was to group the gauges for each year in such a way that the centres of gravity of the groups were as uniformly scattered over the basin as possible. Thus one group might contain twelve or thirteen gauges and another only one, the average number in a group being five or six. In this way from seven to ten groups were arranged for each year. The daily average of each group was then taken, and used as if it represented the reading of an imaginary gauge, situated at the centre of gravity of that group. By doing this all the gauge-readings for any year were reduced to from seven to ten group-averages; and, since the groups were so chosen as to give a uniform distribution of their centres of gravity over the basin, the rainfall of the whole basin could be obtained by simply taking the average of these seven to ten representative imaginary gauges and multiplying it by the area of the basin. In this way all gauges could be utilized, and the grouping tended to reduce the effect of errors in the individual gauges.

The general direction of the isohyets was found by examining the rainfall records; and, as far as it was possible to do so, the long axes of the groups were arranged to be parallel to the isohyets, when the gauges of a group were irregularly distributed in the group.

Having fixed the groups for each year, the next step was to construct tables from which to obtain the averages of the groups and the basin, and to transfer to these the readings on the record-sheets supplied by Dr. Mill. This part of the work is well in hand now, but as there is such a mass of figures to deal with, it will be probably another two months before it is completed. There is an average of about forty gauge-readings for each year, giving 40×365 readings, which for the eight years of records gives 116,800 separate readings to be entered up, added, and averaged as above described. When the final figures for daily rainfall are arrived at, I am aware that the results will not be absolutely accurate, but think that the error ought not to be very great.

Before the total rainfall can be plotted over the discharge-curve the boundary of the river-basin must be marked on the map. As Dr. Strahan found it was not possible to mark the whole water-parting in from the Ordnance sheets alone, it was decided that some one should go over the actual ground and mark in the doubtful parts on the spot. About 113 miles of water-parting remain to be thus marked. Mr. L. A. Sellick, my assistant, is arranging to do this part of the work. I have to thank him, also, for his able assistance in connection with the treatment of the rainfall data and the preparation of tables, etc.

I anticipate that the part of the work referred to in this note will be completed in about three or four months. It is hoped that the superposition of the rainfall upon the discharge curve will give some useful and interesting information, as indicated in my note in last year's report.

There are many points not referred to in this, in connection with the calculation of the rainfall, which call for consideration; but as space is limited, I have confined myself to a description and report on the work in hand.

THE MEDWAY.

Observations on the Medway were brought to a conclusion during the summer of 1910, and the automatic gauges were removed. Mr. MacKenzie reports that he has plotted a diagram showing the daily discharge of the river for the period during which we have fairly reliable records. The diagram covers a period of one complete year and also a separate period of five months. A record of the rainfall for the same periods is required to complete the diagram.

Professor MYRES: This is our Annual Meeting, and before Dr. Strahan presents his communication to us, I ask the attention of the committee to a little formal business. We have in the first place to nominate ten new members of the Department, and the committee submits to the Department certain names. Is it your pleasure to approve of the addition of those names to the list of the Research Department?

[The names were read and approved of.]

I will now ask Dr. Strahan to give us his paper, the Fourth Report of Progress in the Investigation of Rivers.

After the papers, Dr. MILL: This question of the mapping of rainfall is one to which I have devoted a great deal of time, and I do not think there is any possible difficulty in connection with it that has not in its turn come before me. I did not quite gather, from what Dr. Owens said, that he was contemplating working out the rainfall of the Severn basin for every day, or only for periods including a considerable fall of rain. I have been thinking over the same problem with reference to the very much simpler cases of the Exe and the Medway, and I am very grateful to Dr. Strahan for the extremely delicate way in which he referred to my shortcomings in not having produced reports on these rivers. My excuse is that I felt it was a pity to expend a great amount of labour unless there was some reasonable prospect of getting at a result of value. I think that I have now arrived at a satisfactory method for those comparatively small basins, and I hope soon to get to work on them. In dealing with any work of this kind the natural history of rain is a thing that must be taken into account. There are some types of rain that fall very gently and uniformly, and for these the method which has been suggested would work admirably; but unfortunately the heavy rains, in which very large amounts fall, are exceedingly patchy in their distribution, and are difficult to measure, unless the stations are numerous and uniformly placed.

I could not venture to say what degree of probable success would be met with in the methods which Dr. Owens has adopted, but it seems to me that they are likely to be as successful as any other method. I myself would shrink from undertaking such a difficult task for so large an area as the Severn basin. The Exe and the Medway were the largest rivers that I thought it would be safe to attempt, and I hope in their case the result will be satisfactory and interesting. I cannot promise, however, to produce a rainfall curve to superimpose upon a

streamflow curve, because the stream curve is uniform; the stream never runs absolutely dry, and you always have something to go upon, but with regard to rain there may be six weeks at a time without a drop, and the normal fall of two months may come down in a single hour.

Captain H. G. LYONS: I would suggest that the order of the instrumental error of the planimeter used be stated, because we have inter-contour areas given to one part in ten thousand, which is beyond the possibility of planimeters working on a paper surface. The instrumental error of such planimeters is usually about one in two thousand, and then we have also to consider the accuracy with which the boundary-line of the area can be followed, and the unavoidable small errors of that nature. It seems to me that in the table given, four is beyond the justifiable number of significant figures, especially as the measurements were made on one-inch maps.

Prof. HERBERTSON said that he was glad of this opportunity of congratulating Dr. Strahan and his colleagues on the admirable work they were doing. The question of water-supply was becoming so pressing, as more and more was required for industrial, domestic, as well as for agricultural purposes, that it was very necessary to have precise data about river discharge as well as about rainfalls. It was very obvious that some Government department would have to take up the whole problem, but in the mean time Dr. Strahan's work was essential and invaluable.

Dr. J. W. EVANS: All of us, both geographers and geologists, are indebted to Dr. Strahan and his colleagues for undertaking what is clearly a very difficult task. The last speaker suggested that the basin of the Exe was a small area. To my mind, from some points of view it is a very large area, in which a number of the different kinds of rock are represented, and when the present investigation is completed, we shall have to carry on the work on a smaller scale in areas of more uniform character. We must deal with the different tributaries of the Exe in turn, and ascertain the discharge, the material brought down, and other details for each minor basin. That will give us an opportunity of comparing the discharge with the rainfall in different districts, and, what is still more important, the amount of material brought down by streams from areas composed of slates, limestones and other strata respectively. The work to be accomplished in the study of even a single river like the Exe is, however, so great that it must involve patient observation for many years to come.

Rev. E. C. SPICER: The rocks in the catchment area of a river may be divided into pervious and impervious, and these again into hard and soft, soluble and insoluble. On that basis I should like to ask whether there is to be any estimate of the resultant differences in the mean daily summer and winter discharges, and the mean annual discharges of these various rivers. This has been done to a certain extent with the Severn and the Thames. The Severn rises and falls very quickly because its basin is mostly formed of impervious rock, and its waters are muddy. The upper Thames basin is largely soluble pervious limestone, where the water sinks in and emerges very slowly, and the emergent water is clear. It would be very interesting if the amount of material brought down in solution and suspension could also be correlated with the various geological formations referred to in the table.

Dr. STRAHAN: In reply to the remark on Mr. Carter's figures I may say that he was interrupted in his work by illness, and since then he has been in India. I am not sure, therefore, that the form in which his results are presented is such as would have been finally adopted by him.

The determination of the amount of suspended and dissolved matter in the

water of various rivers under varying conditions was one of the objects of this investigation. Arrangements were made accordingly for the taking of gauge-readings on the tributaries of the Exe as well as on the main stream, and for the periodic examination of samples of water from each river. It appeared probable that the character of the water would be affected, not only by the character of the strata cropping out in the drainage-area, but by the character of the weather, for in a rainy period much rain-water would find its way directly into the river, while in a dry period there would be a larger percentage of spring-water. The chemical work on the Exe, however, has not made such progress as was hoped, and no definite result has yet been obtained.

Prof. MYRES: I ask you now to pass a vote of thanks to Dr. Strahan, Dr. Mill, and the others who have collaborated in producing those very valuable reports.

REVIEWS.

EUROPE.

'BRITISH Place-names in their Historical Setting.' By E. McClure. (London: S.P.C.K. 1910. Pp. 349. 5*s*.) This is historical geography in the strictest sense, and a valuable and interesting piece of study. The title, while making clear the purpose of the book, does not foreshadow its arrangement, which consists broadly of a brief history of Britain from B.C. 54 to A.D. 1154, so far as it hinges upon topographical details. These are discussed philologically in elaborate foot-notes. The arrangement makes the work easier for the unlearned to read than most philological works; on the other hand, it is rendered rather irritating to consult on specific names by the practice followed in the index of referring modern names to their original forms.

'The Dolomites' (Grieben's Guide Books). (Berlin: Goldschmidt; London: Williams & Norgate. 1911. Pp. 149. *Maps*. 3*s*.) This appears to be a useful little guide, of conveniently small size, clearly printed. The maps are good and have been anglicized as far as necessary, though we are not clear as to the meaning of a "line of communication" as something between a carriage-drive and a footpath. Full details are given about shelter-huts, mountain inns, and guides.

'The Lands of the Tamed Turk.' By Blair Jaekel. (Boston: Page. 1910. Pp. xiv., 295. *Map and Illustrations*.) The title is picturesque, no doubt, but we miss its application to most of the country traversed, which includes Servia, Bulgaria, Montenegro, Dalmatia, Bosnia and Herzegovina. It is descriptive and appreciative of well-known scenes along ordinary lines of travel in these lands. In fact, the introduction seems to claim more than the book performs in the way of guidance into the unknown. The photographs are very good; the map is not.

'My Balkan Tour.' By Roy Trevor. (London: Lane. 1911. Pp. xxxv., 472. *Map and Illustrations*. 21*s*.) The author is known from previous work as a venturesome motorist; it may be wondered whether this class really indulges in the sort of conversations reported in the prologue and epilogue. These apart, the book is interesting because the point of view is obviously in great part new as the method of travel was new, and motorists at any rate will suspect the author of no exaggeration of his adventures, and will hail him as a pioneer. We feel, however, to have met before something not unlike the illustrations which a publisher's note claims as unique.

'Belgium of the Belgians' (Countries and Peoples Series). (London: Pitman, 1911. Pp. 274. *Illustrations.* 6*s.*) The author has made Belgium his own subject, and this book reveals his intimate knowledge of it to the full. It contains a good deal more than guide-book information; on the popular grottoes of Han, for example, the writer has much to say of interest to the physical geographer, and it is interesting to find how little is really known of the curious hydrographic problem of the Lesse. The historical chapters deal not only with the country at large, but with its principal towns, and the economic resources of the country are studied in great detail.

ASIA.

Persia Twenty-five Years Ago.

'Through Persia in disguise, with Reminiscences of the Indian Mutiny.' By Colonel C. E. Stewart, C.B. London: Routledge. 1911. 15*s. net.*

Colonel Stewart was an officer of the Indian Army whose name is chiefly associated with the 5th Punjab Infantry (old style), but who served in various other regiments, and who sought, like many an Indian officer before him, to qualify for political or diplomatic service by the experience and knowledge gained from extensive travel in the East. He died some years ago, and the book now published by Basil Stewart is compiled from diaries and notes originally written for publication by Colonel Stewart, but of which no use was made during his lifetime. Thus it happens that the freshness of Colonel Steward's geographical explorings has long worn off, and the districts through which he travelled at a time when travelling was full of thrilling episodes, and the information he collected, new to the world of Eastern politics, have either been swept pretty clean by recent map-makers, or superseded by the results of later investigations. The book, in short, is out of date, but this in no wise detracts from its literary merits as a tale pleasantly told of some most adventurous happenings along the monotonous lines of the main routes of Persia, and on the Afghan frontier to the south-west of Herat. The story opens with reminiscences of Mutiny days, but these are but the recollections of a plucky subaltern who was involved in none of the more serious episodes of that stirring time. The chief interest of this life-story certainly lies in that first journey into Persia, when, starting from Constantinople, Colonel Stewart travelled in 1880 *vid* Trebezond and across the Armenian mountains to Erzerum and the Persian frontier, whilst that unhappy country was still suffering from the effects of the Russo-Turkish war. No one travels to Tehran that way now, and it is more than probable that the difficulties and risks of the journey are still much as Stewart found them. It argues much for his determined energy and inherent love of adventure that such disagreeable incidents as were encountered in a famine-stricken land, still infested with bandits, and possessing none of the civilized amenities which decent food and good lodging usually afford, can be recalled in a happy spirit of pleasant reminiscence, and the story told with a plain simplicity which carries conviction of its absolute truthfulness. Once across the Persian border, Colonel Stewart's progress to Tehran, Ispahan, and then eastward and northward across the staring Persian deserts to Mashad were more uneventful. At that time little or nothing was known of the interior of Persia, but the civilization of the West had already begun to penetrate, and telegraph stations under European management were to be found wherever the main line of the Indo-Persian system was encountered. The progress of geographical knowledge of

Persia has been rapid since those days, and where Stewart travelled as a pioneer quite a host of subsequent explorers have since made the way plain—at least in maps. The spirit of careful observation and inquiry was always strong in Colonel Stewart. He could not pass Mount Ararat, for instance, without investigation into its possibilities as the resting-place of Noah's ark. He was unconvinced of the truth of its claim to this high distinction. He thought that the difficulty of getting the animals down from snow-covered and precipitous altitudes as high as Mont Blanc (apart from the question of feeding them) must invalidate the claim. He was probably right. Certainly an elephant on the top of Mont Blanc would present difficulties; but the inquiry was made with all sincerity and reverence.

Apparently Colonel Stewart only assumed the disguise of an Armenian horse-dealer to facilitate his movements when he arrived within the field of Russian or English political supervision. That he believed in his disguise as a protection from Persian inquiry is hardly possible; he was far too well acquainted with Persian methods of investigation to imagine that he could remain unrecognized as an Englishman for long. But it answered his purpose, and enabled him to make expeditions about the Afghan border which would have been impossible without some sort of disguise. Early in 1881 Colonel Stewart returned to England, and after appointment to the Consular service was deputed to Khaf (on the Afghan border of Persia) to acquaint himself with the nature of the surroundings of Herat (so far as he could), and keep an eye on Russian proceedings. Once again he returned to England, and once again made a short visit to Mashad before being invalided home in 1883 and finally despatched on political duty with the Russo-Afghan Boundary Commission under Sir Peter Lumsden. He visited Herat in the genial month of May, when two Engineer officers were deputed to revise the defence of that historic city in anticipation of a Russian siege. The siege never took place, and later, before the Russo-Afghan boundary had become a *fait accompli*, Stewart returned to his native land, and was eventually posted as Consul-General to Odessa.

If this book had been written twenty-five years ago it would have been a useful and even a remarkable record. As it is, the interest of expert opinion on the stormy question of Russia's advance in Asia has been lost, and the story can now only be regarded as a simple and pleasantly told tale of Persian travel with some useful appendices recording the geographical and (to a certain extent) the political views held a quarter of a century ago by a careful and most trustworthy observer.

T. H. H.

Indian Earthquakes.

'The Kangra Earthquake of 4th April, 1905.' By C. S. Middlemiss, B.A., F.G.S., Superintendent, Geological Survey of India. 'Memoirs of the Geological Survey of India,' vol. **38**, 1910, pp. 1–409. 30 *Plates*.

Of the two last great Indian earthquakes we now possess accounts, which are as full and detailed as the conditions of investigation would allow. Mr. Oldham's report on the Assam earthquake of 1897 treats of a disturbance of unusual magnitude and of phenomena of wide and varied interest. Mr. Middlemiss has been less fortunate in his subject, and, if his report on the Kangra earthquake of 1905 is of inferior interest and less fruitful in results, this must be attributed to the destructiveness of the shock and the heavy mortality among those who might have furnished evidence, as well as to the considerable depth of the focus, which rendered the surface manifestations of the phenomena less striking. By the surveys of the central districts, and by

numerous inquiries throughout the disturbed area, Mr. Middlemiss and his colleagues have made an important contribution to our knowledge of a great shock.

The result of their work is a large volume of more than four hundred pages, of which nearly one-half are devoted to the survey of the central area. The volume is well illustrated. There are many photographs of damaged towns and buildings, which testify to the strength of the shock and the completeness of the ruin, and a few—of much greater interest—of rock-slides and a dammed-up lake at Barwar.

Of the three maps, the most important is that which shows the courses of the inner isoseismal lines. Kangra and Dharmsala lie within the central isoseismal (No. 10), and, at these and other places, ordinary houses were reduced to flattened heaps of *débris*. The isoseismal of intensity 8, which traverses all places where slight damage occurred, consists of two detached portions, the larger surrounding the isoseismals 10 and 9, the other, lying some distance to the south-east, enclosing Dehra Dun and Mussuri. A distance of about 120 miles separates the centres of the two portions, and shows how vast is the scale of the movements which result in a great earthquake.

The extraordinary depth of the focus or foci within which these movements took place is illustrated by the entire absence of crustal changes. There were no fault-scarps, no deflection of roads or fences, and no crumpling of railway-lines. The change of elevation, indicated by the repeated levelling along a line from Saharanpur, through Mussoorie to Dehra Dun, is insignificant, being at the most about 5 inches. Mr. Middlemiss endeavoured to estimate the depth of the Kangra focus by means of Dutton's method—a method that is difficult to apply, and defective in principle. He found that it lies between 12 and 21 miles at its north-west end, and between 21 and 40 miles at the south-east end—figures that possibly serve to indicate the order of magnitude of the true depth.

To the geographer, the most interesting section of the report is that which deals with the origin of the earthquake. The two epicentres are situated on the steeply sloping convex side of the Himalayan arc, in the Tertiary rocks of the sub-Himalaya, between which and the older formations of the central ranges there runs a great boundary-fault. Throughout its extent, the sub-Himalayan band is remarkable for the evenness of its course; but in two regions the boundary fault bends sharply to the east, and sweeping round in a great curve, returns to its normal direction. It is exactly in these two regions, where the Tertiary band widens and where the strata are crushed and faulted to an unusual extent, that the two epicentres are situated. As there is practically no superficial movement perceptible, the precise fault along which the displacement occurred is unknown; but there can be little doubt that the origin of the Kangra earthquake is to be sought in a forward slide along more than 100 miles of the central Himalayan mass over the bordering Tertiary strata.

C. Davison.

AFRICA.

African Linguistics.

'Living Speech in Central and South Africa: an Essay Introductory to the Study of the Bantu Family of Languages.' By A. C. Madan, M.A. Clarendon Press, Oxford. 1911. 6*s. net.*

Mr. A. C. Madan is already well known to philologists by his admirable studies of Swahili and of the Bantu languages of Northern Rhodesia between Western Nyasaland and the Kafue river. In the work under review he animadverts,

and with emphasis, on the culpable indifference to the study of Bantu languages still existing in scientific and political circles of the British Empire, pointing out that even when the British Association met a few years ago in South Africa and held sessions so far north as the Victoria falls, a bland indifference seems to have been shown to the study of Bantu speech, either in general or particular; while he is quite right in criticizing the great universities and Government departments with their continued indifference to the study of a language family which would influence profoundly the political development of Africa during the next one hundred years. Another writer on somewhat similar subjects (Mr. F. R. Cana, I believe) has pointed out how similarity in speech enabled the Bantu Herero people of South-West Africa a few years ago to communicate with several Bantu tribes of German East Africa, urging the latter to rise simultaneously with themselves in a common attack on the German invader; and although German forces were enabled after several years to get the better of both (to their ultimate advantage, the present writer believes), still this incident was typical of much that will follow in the growth of community of feeling throughout the southern third of Africa induced by a community of language structure. Chapter iii. is particularly interesting—Bantu in relation to general philology. And the author is right in praising the 'Cyclopædic Dictionary of the Mangánja Language,' by the late Rev. David Ruffele Scott. In chapter iv., on Word birth, the author propounds a theory which is interesting, even if it does not command universal acceptance. His remark that Bantu roots may be traced back to a monosonant (a term he prefers to monosyllable) is perhaps in the main correct, for although many of these roots would seem to be composed of two or even three syllables, these again can frequently be split up into the collocation of separate monosyllabic terms; thus, for example, *ndiba*, a very common Bantu root-word for "water," seems to be composed of two distinct roots, *ndi* and *ba*, both of them existing separately as root-words meaning "water" in Sudanese and West African languages. Chapter v. deals further with the birth of words, many Bantu roots, according to the writer, being due to interjections and to onomatopœia, such as, for example, the word *gogodo*, for "cantering along a road." Undoubtedly, a good many words in the numerous Bantu dialects and languages are formed by direct inspiration, so to speak (as they are in modern English), as interjectional sounds intended to imitate more or less correctly actions, noises, movements, etc. But some of the syllables instanced by the author, which are used as suffixes or prefixes, have an older history, and are not directly born in recent speech as interjections. In the chapter on noun-prefixes and their concord, the author seems to have overlooked some recent writing by Mons. Jacottet, Miss Werner, myself, and others, on the older forms of the concord particles, especially those related to classes 1 and 3. It is misleading to give the simple vowel *u* as the concord for classes 1 and 3, and *i* for class 4, when the original forms were almost certainly *ngu* and *ngi*. The original concord for the prefix of the 6th class (*ma*) was originally *nga*. Consequently, I do not entirely agree with the deductions in chapter xiv. regarding the forms of the pronouns, though there is much in it which is indisputable. The concluding chapter is of interest to all who are studying the development of Africa from a practical point of view. Herein the author shows that several Bantu languages are already passing into the literary stage, with newspapers and an enormous volume of native correspondence carried by the mail service. The flexibility and wealth of expression in many of the Bantu tongues is not overrated.

"As with aviation, so with other ideas and objects as they dawn on Bantu

intelligence: means to express them will not be wanting. His ethics may so far find two words or so enough to cover all distinctions known to him between the merest flaw and deadly sin; his æsthetics the same number for all pleasures and pains of sense, taste, and feeling, where two hundred would but moderately equip a civilized mind; his appreciations of colour are mostly limited to three varieties, and those mainly dependent on light and shade. But for all that concerns his house-building, cooking, cultivating, forestry, care of cattle, hunting, fishing, fighting, and the like, or argument for his rights, there would be found no lack, taking the various dialects together, of a nomenclature as full and, for its purposes, as exact as that of a modern miner or engineer."

H. H. JOHNSTON.

THE FRENCH SUDAN.

'Notre Beau Niger.' By Félix Dubois. *Illustrations and Sketch-maps.* Paris: F. Flammarion, 26, Rue Racine. 1911. 5 *frs.*

M. Dubois has for many years been greatly interested in French West Africa. On the morrow of its occupation by the French he visited Timbuktu, and at that time, when throughout France the Upper Senegal—Middle Niger region was considered to be without resources and without a future, he became convinced of its natural richness, the commercial aptitude of its peoples, and the suitability of its climate to Europeans who lived in a rational manner. After fifteen years' absence he revisited the country (by way of the Sahara), and the book before us gives the result of his latest observations. He has a wonderful story to tell of the success which has attended the devoted labours of the French in that part of West Africa. It is as important and beneficial a work as that accomplished by British officials in the Anglo-Egyptian Sudan, and inasmuch as the French Sudan is more fertile than the country ruled from Khartum, and its inhabitants more numerous and more civilized, greater results have been achieved. M. Dubois tells his tale with vivacity and in an easy, luminous and engaging manner, and his book should have many readers among English people.

All those interested in the development of the tropical part of the continent now know something of the material progress made by the French in West Africa. It will be more useful therefore, instead of following M. Dubois in those chapters in which that progress is detailed, to consider some of the matters on which he offers criticism or suggestions. They are worthy the consideration of British colonial administrators. His principal pre-occupation is with the character and future of the natives, and his ideal is that they should become *Français Noirs*. M. Dubois prefaces this part of his book with historical and ethnological notes, and he rightly insists on the strong infusion of non-Negro blood in the peoples of the Niger, differentiating them sharply from the inhabitants of the Guinea coast lands. To make these "Nigerians," or any other native race, mere hewers of wood and drawers of water, which is the aim of some European nations in their African possessions, is a policy the author strongly condemns. In short, he advocates what is known as the Cape policy as opposed to the Boer and Natal method of treating the natives. Happily, in West Africa the white and black races have not to live side by side as in South Africa, and this vastly simplifies the problem. As M. Dubois says, "la mise en valeur du Soudan ne demande pas d'émigrants. Il lui faut des individualités et des capitaux. . . . On voit assez que le véritable colon de nos colonies doit être l'indigène et que, pour nous, 'coloniser' signifie éduquer l'indigène." And the human material is new, plastic; the natives have shown themselves not only apt to receive the French imprint, but even desirous to acquire it. The

chief method by which the natives should be led in the right way is, naturally, the French school. M. Dubois utters a well-reasoned and weighty warning against the encouragement (now given) of Islam by the Government, and protests vigorously against the maintenance of a Moslem university at Jenné established by the administration. Islam, he holds, has not raised the morale or mentality of the West African. It is not understood by them, while its theocratic basis is a political danger. "L'école laique et française, seule, peut et doit nous donner les cadres civil indigènes dont nous avons besoin," and a vigorous protest follows concerning the inadequacy of the French schools provided.

Great importance is attached by the author to the proper housing of European officials; to the moral effect on the natives of providing fine buildings for public offices (as has been done at Bamako); and to the conservation of native arts and crafts. He laments the vandalism which has pulled down the walls and some of the old buildings of Jenné; a city whose commercial importance is rapidly declining, for reasons which cannot here be set forth. (The chapter on Jenné forms a very useful lesson in the study of commercial geography.) On economic questions in general M. Dubois has much sound advice to offer; he shows why cotton-growing in the French Sudan has failed, and asks his compatriots to study in this matter English methods; he states his belief in the possibility of a trade in Nigerian rice with Algeria *viâ* the Sahara. Finally, we may mention an illuminating passage concerning the doings of Herr Leo Frobenius in the Niger Bend—a passage which makes it easy to understand how the German traveller came into collision with the British authorities at Lagos.

F. R. C.

'The Land of Veiled Women' (London: Cassell. 1911. 6s.) is an account by Mr. John Forster Fraser of recent wandering in Algeria, Tunisia, and (to a small extent) in Morocco. Mr. Fraser has travelled a great deal and has an observant eye; in this instance, he gives descriptions of town and country, but is largely concerned with the women folk of North-West Africa, of whom he draws many a lively picture. His sketches, whatever their subject, are impressionist and generally over-vivid, but they convey definite ideas and a realistic atmosphere. One of his best chapters deals with the economic development of Algeria. There are numerous good illustrations, some in colour.

'A Resident's Wife in Nigeria.' By Constance Larymore. 2nd edit., revised, (London: Routledge. 1911. 4*s.* 6*d. net.*) Mrs. Larymore went to Nigeria in 1902 and spent a considerable period in the country, accompanying her husband on his official tours to remote districts. Out of her experiences she made a notable and eminently readable book, originally published in 1908. The author has taken advantage of the issue of a new (and cheaper) edition thoroughly to revise her narrative and to add a chapter concerning her last visit to the country, during which she suffered shipwreck in the Niger. Part II., which consists of advice concerning the home, household, domestic animals, the garden, camp life, and clothing, should be read by all who may have to live in West Africa. A sketch-map, elementary but sufficient, has been added in this edition. We may note that since it was printed the railway to Kano has been completed.

POLAR REGIONS.

Greenland.

'Sommerfahrten in Grönland.' Von Dr. Martin Rikli und Dr. Arnold Heim. Verlag von Huber & Co. in Frauenfeld. 1911. Pp. 262.

'Bei den Eskimos in Westgrönland.' Von Dr. Rudolf Trebitsch. Verlag von Dietrich Reimer (Ernst Vohsen) in Berlin. 1910. Pp. 162.

Much has been written about Greenland, its inland ice, glacier tongues and icebergs, its fauna, flora, and inhabitants; and the *Meddelelser om Grönland* contains a vast mass of varied information. Nevertheless, scientific travellers, such as the authors of these books, still find scope for their investigations. Dr. Rikli, professor of botany at Zurich, devoted his attention particularly to the flora, while Dr. Heim was commissioned to inspect the coal and graphite mines of Disco and Nugsuak on behalf of the Greenland Mining Company. Dr. Trebitsch made a collection of ethnological objects, which are described by M. Haberlandt, and also obtained phonographic records of Eskimo songs, poems, and tales; while his companion, Dr. Gustav Stiasny, collected zoological specimens. The customs and manners of the Greenlanders, their implements, boats, etc., are described in both books, and much that is here reported is well known from other writers. The Danish settlements are, however, portrayed as they are to-day, and little is heard of them except through Danish sources and scientific visitors like the authors of these books, for only such are allowed by the Danish Government to land in its possessions. Dr. Trebitsch was refused permission on his first application, when he expressed a wish simply to see the natural beauties of the country. He maintains, in opposition to the opinion of Dr. Nansen, that the exclusion of Greenland from the commerce of the world is beneficial to the Greenlanders, on the ground that, unlike other primitive peoples, they are increasing in numbers. But the Greenlanders are not pure Eskimo; they have a large admixture of Danish blood.

Arctic Tides.

'Arctic Tides.' By Rollin A. Harris, Coast and Geodetic Survey. Washington: 1911.

An interesting account has been put together by Mr. Harris of all the result so far available of tidal observations in Arctic regions. The very accurate work done during Peary's recent polar expedition has received the full discussion that it well merited, and has been brought into line with previous work. The chief point of interest in the investigation is undoubtedly the hypothesis that a large trapezium of land, nearly 500,000 square statute miles in area, exists in the Arctic ocean. Nansen's work in the *Fram* has led to the general assumption of a deep ocean basin over the whole polar area north of the known land-masses. For an area between 120° and 175° W. long. and between 77° and 85° N. lat. this assumption is now challenged, and it is of much interest to consider the reasons given for the new view. The only point of land actually known to exist within this area is Crocker Land, discovered by Peary, north-west of Grant Land. A shoaling north of the 85th parallel observed by Peary suggests the northern boundary of the land. The rest of the evidence comes entirely from the tides and the driftings of the currents. And here a note of caution must be sounded. Mathematicians on this side of the Atlantic, while gladly recognizing the very valuable work that Mr. Harris has done in his researches on the tides, are far from being in general agreement with him in his

theory of "resonance" tides. Before they can support his contentions as to this hypothetical land, they naturally must inquire how far his argument depends upon the features of his theory with which they are not in accord. It may be said at once that the main body of the evidence in favour of the existence of this land is not dependent upon Mr. Harris's special theories. In the opinion of the reviewer, a good case has been made out for channels running from the north-east coast of Alaska across to Peary Land, even though the existence of dry land beyond the shoaling regions cannot be said to be proved. Several difficulties and inconsistencies in the behaviour of Arctic tides have been cleared up by Peary's records. Thus we are now apparently relieved to some extent of the difficulty of progressive waves entering the Arctic ocean northwards by all the three openings from the seas outside. Again, some erroneous data by early observers have now been safely discarded, a fact which has in one instance helped materially towards simplifying the theory. It may be stated here, in view of previous remarks, that Mr. Harris's theory accords well with the conditions that obtain in polar regions, and that even from the point of view of his critics, this work on the Arctic tides must rank as an investigation of very considerable value. The reviewer has one slight criticism to make. For readers not well acquainted with the geography of Arctic regions, an additional map not covered with cotidal lines and having the names of places clearly printed would be of considerable assistance.

F. STRATTON.

GENERAL.

HISTORY OF CARTOGRAPHY.

'Die italienischen Portolane des Mittelalters, ein Beitrag zur Geschichte der Kartographie und Nautik.' Von Konrad Kretschmer. (Veröffentlichungen des Instituts für Meereskunde und des Geographischen Instituts an der Universität Berlin.) Berlin: 1909.

Dr. Kretschmer's ambitious work on the Italian Portolani is divided into four main sections, "Die Mittelalterlichen Seekarten" (pp. 34–148); "Die italienischen Portolane" (pp. 149–232); "Portolan-Texte" (pp. 233–552); "Kommentar" (pp. 553–687). Besides these, we have a summary of the maritime history of the South European peoples from the time of Phœnician activity to the end of the Middle Ages (pp. 8–33).

Under the title of "Mediæval Maritime Maps," we have first some remarks on the compilers of the same; on the compass-lines and the orientation of these designs; on their technique, colouring, writing, nomenclature, and system of measurement (the "portolan mile," etc.); and a study of the manner in which certain natural and other features are delineated (hills, rivers, towns, etc.). Next we have an elaborate discussion of certain points vitally affecting these mediæval sea-maps, especially questions as to their origin, the early history of the compass, the problem of the compass-charts, the Dati maps, the supposed relations of mediæval to ancient sea-maps. This is followed by a list of Portolani, from the earliest examples known, through the fourteenth and fifteenth centuries, down to 1497, with remarks upon each.

Under the heading of "Italian Portolani," the author first briefly studies the ancient Peripli; next, with greater elaboration, the content and arrangements of the mediæval Portolans; and, lastly, certain Portolani and Portolan-fragments in detail, beginning with a fragment of such character from the Scholia to Adam of Bremen.

Finally, the "Commentary" gives us explanations of the Portolan names

along the various coasts of the known Western world, beginning with Germany, Holland, and Flanders; proceeding to England, Ireland, Portugal, and Oceanic France and Spain; dealing next with the Mediterranean and Black sea; and concluding with the north-west Atlantic coast of Africa, and with certain Atlantic islands—Canaries, Azores, and Madeiras.

One of the most interesting points in this work is certainly the treatment of the "Portolanfragment bei Adam von Bremen" (Scholion 96), in which the abbreviated material is given for a 'routier' from the mouth of the Maas to the Holy Land ('De Ripa in Flandriam . . . ad Accharon'), and which from manuscript evidence must apparently be assigned to the end of the twelfth or beginning of the thirteenth century.

It seems somewhat perverse to bring in Guyot de Provins (p. 70) as the first clear witness to the use of the magnet-needle in the west, when Dr. Kretschmer himself assigns Guyot's 'Bible' to 1190, and Neckham's magnet-references may so plausibly be fixed to about 1180–86. Queer specimens occur both of English and French citation. Not too generous a spirit is shown to some of those who have worked at the subject of this inquiry; but that does not alter the fact that we have here a contribution of great value to the literature of the "First true maps." Much that is imperfect or obscure in Nordenskiöld is here more thoroughly worked out. Among the many sections of special merit we may perhaps pick out as especially helpful the treatment of the question of Flavio Gioja of Amalfi (p. 74, etc.).

C. R. B.

French Colonial Railways.

'Les Chemins de fer coloniaux français.' Par R. Godfernaux. Paris: Dunot et Pinat. 1911.

A comprehensive and exhaustive volume on the railways of the French colonies in Eastern and Western Africa, Indo-China, and other miscellaneous dependencies, such as Madagascar, Guiana, French Somali coast, New Caledonia, Réunion, etc. It is interesting to observe, especially at the present moment while German and French colonial aspirations are so much in evidence, that the total superficial area of the French colonial possessions is 7,011,503 square kilometres, and that the population is roughly over 41 millions, or actually more than that of France itself. The exports and imports of these amounted in 1909 in the aggregate to more than 1090 millions of francs in value, a very substantial increase on the figures for 1908. The total mileage of the railways already constructed is 4328 kilometres, in addition to which 1239 kilometres represent the length of the railways under construction. The aggregate does not seem so very important, considering the vastness of the scattered regions over which the lines are built; but when we bear in mind that these comprise various lines from the coast to the Niger, from the coast to the capital of Madagascar, from Jibuti to the capital of Abyssinia, and especially from the coast of Indo-China to Yunnan-sen, it will be realized that the future commercial importance of these railways is far greater than might be inferred from their length. There are several useful maps and a profusion of engineering plans, sections, and elevations of the various works completed and under construction.

THE MONTHLY RECORD.

EUROPE.

Origin of the Valley of the Charente.—This subject is discussed in detail in a paper by M. Passerat in the *Annales de Géographie* for May 15, 1911. The writer points out that the singularly winding course of the Charente, bearing no relation to the present topography, is the resultant of long processes of evolution, the principal stages in which he endeavours to trace. The drainage area of the river is almost entirely composed of plains of Jurassic and Cretaceous limestone, connecting the platform of Poitou with the basin of the Garonne, and resting against the flanks of the central crystalline *massif*, the whole forming a peneplain inclined to the west. The evolution of the present surface has depended on tectonic movements possibly associated with the elevation of the central *massif*, which gave rise to a series of synclines and anticlines (the latter sometimes fractured) running from north-west to south-east. Of these the most important was the anticline separating the Seudre from the lower Charente, and followed to the north-east by the syncline in which the town of Saintes is placed. A second factor of importance is a sort of horst bounded by faults on the north-east and south-west, in the extreme north of the basin about the town of Melle. As a result of these dislocations two main depressions existed—the Saintes synclinal, and the basin of Lezay to the north-east of the horst just mentioned, into which depression two independent drainage systems debouched. In the subsequent course of events four cycles of erosion can be distinguished, to the second of which the broad features of the existing relief are due. It produced a system of plains sloping to the west, which in turn were modified by a third erosion-cycle, the operation of which is characterized by extensive terraces, especially in the Charente valley between Angoulême and Cognac. During this cycle the present course of the Charente took shape. For a considerable part of its middle course the river occupies a monoclinal valley, due to the disposition of the strata and their unequal resistance to erosion. That the river abandons this valley near Cognac, in order to cut through the Cretaceous plateau, is explained by the vicinity of the Saintes syncline and the confluence of various consequent streams from the north-east. On the other hand, the sharp bend of the upper Charente at Civray is the result of capture of the present upper course owing to the more rapid fall on the southern versant of the old divide. The fourth cycle was marked by a deepening of the river-valleys owing to a depression of the base-level of erosion below the present sea-level, causing them to flow between high banks. This is the case even in the most winding part of the main river, the previously existing curves having become fixed during the process.

New Railways for Sweden.—The issue of *Export* for June 8 of this year gives a short summary of the proposals lately made by the Swedish Government for important extensions of the railway system of that country, for the purpose of supplying the needed transport facilities to the areas, principally in the northern interior, which have hitherto remained outside the general network of railway communication. At present, besides the northern trunk-line which goes to the Finnish frontier by a route parallel to, and at no great distance from, the coast of the Gulf of Bothnia, the only lines in existence in the northern half of Sweden are the two transverse lines leading from the coast at Sundsvall and Lulea respectively to the Norwegian frontier, with continuations to the Atlantic ports of Trondhjem and Narvik. The main part of the new

scheme, the carrying out of which will occupy ten years, is the construction of an inland line, generally parallel to the existing northern line, across the wide space lying between the above-mentioned transverse lines. It will start from the city of Oestersund on the Sundsvall-Trondhjem line and terminate at Gellivare, the great mining centre on the Lulea-Narvik line, opening up a vast region of which timber and associated products are the principal natural resources. A southern continuation of this inland railway to the Cattegat has been abandoned for the present on the score of cost, but it is proposed to construct a shorter line connecting Oestersund with the railways of Dalecarlia. A new transverse line, crossing the proposed inland line in its southern portion, is also contemplated, while a branch to the Porjus waterfall near Gellivare—to be used in connection with the electrification of the Lapland railway—has been taken in hand. Work has already been begun on the southernmost section of the inland railway, viz. from Oestersund to Ulriksfors, 80 miles, and this is expected to be open before the end of the year.

ASIA.

Fluctuations of the Level of the Dead Sea.—The visit to the Dead sea made last April by Dr. E. W. G. Masterman, whose observations on the level of the water have been recorded for some years past in the Palestine Exploration Fund *Quarterly Statement* (cf. *Journal*, vol. **20**, p. 101), showed that the water had then reached a higher level than had been observed since the measurements were commenced. The season had been an unusually rainy one, the record for Jerusalem being 33·8 inches up to the date of the visit, while a further 3 inches had fallen when the notes were written. As a result, the Dead sea had risen 2 feet 2½ inches since the previous autumn, and stood 1 foot higher than during the previous spring. A distinct though somewhat smaller rise was observable in the pool at 'Ain Feshkhah. In this connection it may be mentioned that, according to a note in the August number of *Petermanns Mitteilungen*, a German expedition for scientific research in the region of the Dead sea has been organized by the Berlin Society for the Exploration of Palestine, and will set out this autumn under the leadership of Dr. L. Brühl.

Eruption of Usu-san in 1910.—Prof. F. Omori has published an interesting preliminary report on this eruption in the *Bulletin of the Imperial Earthquake Investigation Committee* (Tokyo, vol. **5**, 1911, pp. 1–38, pl. i.–xii.). The volcano is one of a group of four, situated in the south-western portion of Hokkaido, in the neighbourhood of Volcano bay. The crater is comparatively small, being little more than a mile in length and 2270 feet in height. It is bounded to the north by Lake Toya. The eruption was preceded for about four days by numerous earthquakes and earth-sounds, which increased in frequency until about twenty-four hours before the first explosion, which occurred at 10 p.m. on July 25. This was followed by explosions from nearly fifty newly formed craterlets, which lie in three zones, the most important being a curved band more than a mile in length and lying about half a mile from the shore of Lake Toya. In the region between the main zone and the lake not a single craterlet was formed. Most of the craterlets remained in action for some hours, a few for several days. At no time was the eruption violent, and there was no outflow of lava. The most remarkable feature was the rapid elevation of the tract between the main zone of eruption and Lake Toya. This was first noticed by Prof. Omori on August 6, at a point where the shore of the lake had risen about 3 feet. Farther inland the upheaval was more considerable, and, by August 20, the elevation of a new mountain began to attract general attention.

The ridge of this mountain, originally at a height of 180 feet above the lake, was raised to a height of 690 feet by the beginning of November, so that the total elevation was 510 feet in a hundred days. This, however, was lessened during the following months, for in April, 1911, it was 120 feet lower. The upheaval of the new mountain, in Prof. Omori's opinion, was caused by the thrust of subterranean lava-masses, which gave rise to the preliminary earthquakes by the formation of fractures, through which gases and vapours escaping resulted in the explosive stage.

AFRICA.

M. Pervinquière's Journey to Ghadames.—In referring to the delimitation of the frontier between Tunis and Tripoli (July number, p. 74) we referred to the scientific mission carried out in connection with that operation by the well-known geologist, M. Pervinquière. This traveller, who was commissioned at a day's notice, last February, to undertake a geological examination of the region adjoining the boundary, with a view to testing its mineral resources, has given an account of the journey before the Paris Geographical Society, in whose *Bulletin* for June last the paper is printed. Although visited by many of the earlier travellers, Ghadames had been practically closed to Europeans for the last forty years, only one traveller—Cornetz—having succeeded in entering the place, and this in disguise and for only a few hours. The favourable conditions due to the operations of the commission made it possible for M. Pervinquière to reach Ghadames within eighteen days after leaving Paris. His account of the route followed and of the present condition of Ghadames is of much interest. The Jefara or coast-plain of this part of North Africa was left behind at Dehibat, where the ascent of the cliff which runs for hundreds of miles through Tunis and Tripoli led to the nearly level plateau of the Dahar, marking the beginning of the Sahara. At Zar the deposits which some had taken for nitrates, and on the exploitation of which hopes had been built, proved to be merely gypsum with a mixture of calcite crystals. The route led over a succession of stony plateaus, almost destitute of vegetation, and at one point across an arm of the Great Erg or sea of sand-dunes. Before the climate became as dry as at present, erosion was active in this region, and traces of the old river-valleys are still to be seen, partly buried by the sands. Specimens of the flint worked by the old inhabitants were procured. A distant view of Ghadames showed the place like a dull green streak on a yellowish-grey ground, this latter being supplied by a small cliff at the foot of which the oasis is placed. The houses are of the Sudanese type, and there is a striking absence of minarets, though mosques are to be met with. Many of the streets are carried underground, the houses on either side meeting above them. The town and its gardens are surrounded by a dilapidated wall, and the whole place gave an air of decadence, many of the gardens having been abandoned and the palm-trees allowed to perish. The place owes its existence to a fine artesian spring, from which all the gardens are watered, but the supply does not appear to exceed 2000–3000 litres per minute. Commerce is in a decadent state, and the population is stationary at from 5000 to 6000 souls. The people are Berbers, with some Arab and much Negro blood. They are completely dominated by the Tuareg (of the Ifogha group), who are physically far finer. They have a permanent camp on the Idoles plateau not far from Ghadames. There seems little prospect of a revival of prosperity under Turkish rule.

The Austrian Expedition to Tibesti.—The expedition planned by Dr. Artbauer for the exploration of Tibesti (*Journal*, vol. **37**, p. 95) seems hardly

likely to realize the expectations formed of it. The second European member, Lieut. von Helmhacker, who had proceeded to Tripoli in advance to make preliminary studies and arrangements, has severed his connection with the undertaking, apparently through difference of opinion as regards the proposed arrangements, while Dr. Artbauer does not appear to have left Vienna. Meanwhile some of the results of Lieut. von Helmhacker's inquiries as to the state of affairs in Tibesti and Kufra are recorded in the August number of *Petermanns Mitteilungen*. They tend to confirm the reports of the forward movement of Turkey in both regions, especially in Tibesti, where not only has a Turkish Kaimakam been appointed to Bardai, but garrisons appear to have been established both there and at Tao. A regular, though scanty, intercourse seems to be maintained between Fezzan and Tibesti, with military support, and no great obstacle to the advance of a small but well-equipped expedition to the latter region is thought to exist, provided the support of the authorities were obtained. The presence of a Turkish Kaimakam at Kufra seems confirmed, though no Turkish garrison appears to have been established in the oasis.

Delimitation of the Franco-Liberian Frontier.—The final task of marking this boundary on the spot in accordance with the recent agreement is now being undertaken by a joint commission representing France and Liberia. The French party is under the direction of Captain Schwartz, who sailed for Konakri in June. The commission will begin work on the part of the frontier lying between French Guinea and Liberia, afterwards proceeding to the side adjoining the Ivory Coast. Captain Schwartz will, as is stated in the *Revue Française* for July, subsequently undertake the marking of the boundary between Dahome and Togo, on the survey of which he served as second under Captain Fourn two years ago.

The Anglo-Italian Frontier at the Mouth of the Jub.—As is known, the frontier between British East Africa and Italian Somaliland is in part constituted by the lower course of the Jub river, so that when the recent change in the mouth of the latter, alluded to in the *Journal* (vol. **34**, p. 571), took place, it became a question whether the old or the new mouth of the river should form the boundary. If the former, Italy would have been cut off from the main entrance to the river, which had shifted about 1½ mile to the south. Towards the end of last year a mixed commission discussed the question on the spot, but, failing to come to an agreement, referred the decision to the home Governments. We understand that it has now been agreed that the new mouth shall in future constitute the boundary, so that Italy gains the desired access to the navigable waterway.

Rhodesia-Congo Boundary.—The note in the last number of this *Journal* on the "Rhodesian Boundary with the Belgian Congo" was incorrect. The facts of the case are as follows: The two Governments concerned have agreed to survey the frontier region between Lakes Tanganyika and Mweru and between Lake Bangweulu and the Congo-Zambezi watershed, and also to survey and demarcate the boundary along that watershed as far west as the meridian of 24° east of Greenwich. The British Commissioner is Major R. A. Gillam, R.E., and his Belgian colleague is Major Begrand. The assistant commissioners on the British side are Captains Everett and Walker and Lieuts. Gore-Browne and Wynne. Six British non-commissioned officers form part of the commission. The whole party sailed for South Africa on July 29. It is expected that the work will take two years.

AMERICA.

The First Ascent of Mount Olympus.—We have received a cutting from the *Boston Evening Transcript* of June 3, in which the question of the first ascent of Mount Olympus (see *Journal*, vol. 37, p. 565) is discussed by Mr. J. Ritchie, who points out that the ascent by Prof. Parker and Mr. Browne took place as far back as 1907, and that it has not been conclusively proved that those climbers actually reached the highest summit of the mountain. The article by Mr. Browne in the *Bulletin* of the American Geographical Society, on which our previous note was based, gave no clue to the date of the ascent referred to, and we therefore supposed that it had been made in 1909 or 1910. Mr. Ritchie describes an ascent—also made in 1907, and only a short time after that by Prof. Parker's party—by Mr. L. A. Nelson and ten other members of a newly-formed mountaineering club at Seattle, who had already made arrangements for the climb before their rivals arrived on the scene. Mr. Nelson's party (which included the State geologist of Washington and four university professors), appears to have climbed both the middle and western peaks of the mountain, finding the latter slightly the higher of the two. It is identified by them with the Olympic peak of Mr. Browne, which does not appear to have been climbed by the earlier party, so that if the Seattle climbers were right in supposing it the higher, they were, it is claimed, the first to make the complete ascent.

Boundaries of the State of Michigan.—An interesting study of the evolution of the present boundaries of the state of Michigan, by Mr. G. J. Miller, appears in the *Bulletin* of the American Geographical Society for May of this year. The ordinance which, in 1787, organized all the territory of the republic lying north of the Ohio and east of the Mississippi, provided that, besides the three states then proposed to be constituted, one or two additional states might in the future be formed in that portion of the territory lying "north of an east-and-west line drawn through the southerly bend of Lake Michigan." By an Act of Congress in 1805, the territory of Michigan was defined as bounded on the west by "a line drawn from the said southerly bend (of Lake Michigan) through the middle of the said lake to its northern extremity, and thence due north to the northern boundary of the United States." * Difficulties soon arose in regard to the southern boundary, which, if drawn according to the definition of 1787, would have excluded both Ohio and Indiana from their desired access to portions of Lakes Erie and Michigan; the possession of the important port of Toledo on Lake Erie being the special object of contention between Ohio and Michigan. The former eventually carried the day, Michigan receiving in compensation the rights of statehood (hitherto denied) and an extension northwards between Lakes Michigan and Superior. A modification of the original line was also made in favour of Indiana. Further north, the boundary was also the subject of much dispute. In 1818, the whole area north of Illinois and between Lake Michigan and the Mississippi had been temporarily annexed to the state of Michigan—an unsatisfactory state of things, by reason of the great distance of that territory from the seat of government and the barrier offered by Mackinac straits. But

* If this definition is correctly quoted, it seems strange that its ambiguities did not give rise to disputes in course of time, but none such are spoken of by the writer. It appears to have been tacitly accepted that the line in question was a north-and-south line throughout, though this would pass neither through the middle of the lake (on any interpretation of the phrase) nor through its most northern point.

though, after the formation of Wisconsin, a strong agitation arose for the annexation of the whole area north of Lake Michigan to that state, it failed to bring about the desired result, and the present boundary, discordant as it is with geographical conditions, was secured by Michigan. Separated by waters which are blocked by ice for part of the year, Upper and Lower Michigan can never form a single geographical unit. Their economic interests are in striking contrast, while the development of railways has tended more and more to unite Upper Michigan with the west and loosen the ties with the rest of the state.

AUSTRALASIA AND PACIFIC ISLANDS.

Physical History of Wellington Harbour.—This is discussed by Dr. J. M. Bell in a paper printed in the *Transactions of the New Zealand Institute*, vol. 42, a reprint of which (Wellington, 1910) has been received. The harbour of New Zealand's capital is a fine piece of water, about 9 miles long by 5 wide, land-locked except at the narrow entrance, only 88 chains wide. It is almost completely surrounded by hills rising steeply from the water. Those to the west attain a very uniform height, and as this even sky-line is independent of structure, it apparently represents an odd peneplain. To the east are three successive ridges each rising to a nearly uniform altitude, and apparently marking various levels of the old peneplain surface. Following the formation of this, the land-surface was once more elevated relatively to the sea, and—either as a partial expression of this elevation or subsequently to it—came a series of faulting movements which separated the blocks on the east and tilted that to the west, at the same time forming the depression now occupied by Wellington harbour. This trough was probably not at first entirely beneath the sea, but was occupied by a large stream, the antecedent of the present Hutt river. The existing low-lying area does not represent a single depressed block, but consists of several parallel and transverse blocks, which have settled down unequally. Since the final depression the surface has been much modified by erosion, which has dissected the original flat blocks into ridges and valleys. The major faulting movements, which find their most marked expression in the line of weakness coincident with the western shore-line of the harbour, probably date from late Tertiary times and have been continued down to the present, as indicated by raised beaches and various recent manifestations of seismic activity in this region.

POLAR REGIONS.

Mr. Mikkelsen's Expedition.—It is stated in *Petermanns Mitteilungen* that the first ship which reached Copenhagen from West Greenland this season brought no news of Mr. Mikkelsen, so that it would seem certain that the traveller had not succeeded in making his way across to the west coast, and considerable anxiety must be felt for his safety. The well-known explorer Rasmussen has undertaken a sledge journey northward along the west coast with a view to crossing the inland ice to Sherrard Osborn fiord, and making his way through Peary channel to Glacier cape. Although his primary object is survey, he would endeavour also to obtain some news of the missing explorer.

Australasian Antarctic Expedition.—Dr. Douglas Mawson, who left London for Australia in June, arrived at Adelaide towards the end of July, and is now completing the arrangements for the final departure of his expedition from Hobart before the close of the year. As promised to Dr. Mawson before he left England, a Treasury grant of £2000 towards the expenses of the expedition has been provided for; the Australian Commonwealth Government

has made a grant of £5000. His ship, the *Aurora*, which was built at Dundee in 1876, arrived in the Thames from Newfoundland in June, and was placed under the command of Captain J. K. Davis. After undergoing extensive alterations, she sailed from the West India Docks on July 27, was "swung" for the adjustment of her compasses under the direction of the Admiralty officials at Sheerness, and then proceeded to Cardiff to take on board supplies of coal, finally leaving these shores on August 4, bound for Cape Town and Hobart. She is a roomy vessel of her class, a little smaller than the *Terra Nova*, her dimensions being—length over all, 165 feet; breadth, 30 feet; depth, 18 feet; gross register, 580 tons. She is fitted with a compound engine of 98 nominal H.P., and is capable of a speed of 9 knots an hour. A new multitubular boiler was put into her in 1905, and under steam she consumes 11 tons of coal a day. For sailing purposes in the Antarctic seas, her rig has been altered from that of a schooner to that of a barquentine. The accommodation aft has been remodelled, so as to serve the requirements of the large scientific staff she will carry from Hobart to the shores of the Antarctic continent. Other alterations include the erection on deck of a biological and a general laboratory. Most of the staff will join in Australia, the only members sailing from this country in the *Aurora*—besides the ship's officers—being Dr. Mertz, a Swiss zoologist, who is an experienced mountaineer, and who won the Swiss ski-jump championship in 1908; and Lieutenant Ninnis, Royal Fusiliers, who will take part in the survey work. At the request of the Prince of Monaco, who has provided the expedition with its oceanographical equipment, Dr. Mertz went through a special course of training at the Monaco Oceanographical Laboratory and on board the *Princesse Alice*. A valuable equipment for magnetic work has been lent by the Carnegie Institution of Washington. The *Aurora* carried, when she left England, forty-eight Greenland dogs, obtained through the kindness of the Danish Government, and a large number of Norwegian-built sledges, as well as the bulk of the stores and food supplies for the three parties which it is hoped to land between Cape Adare and the Gaussberg.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Warmth of North-Western Europe.—This familiar subject is discussed by W. Köppen in the *Annalen der Hydrographie*, Heft III., Jahrg. 39, 1911. The author deals mainly with the causes which contribute to the high mean temperature for the latitude of the European continent, more particularly the north-western portion. The primary cause he regards as the warm northward-drifting surface water of the North Atlantic ocean, and then comes the frequency of south-westerly winds. In our opinion, these two factors are equally important, and should be classed as one; they are indeed dependent on one another for their efficacy in raising the winter temperature of western Europe. If, on the one hand, there were a continental mass of land to the south-west of the British Islands, south-west winds would be chilled below the freezing-point in winter long before they reached the high latitude of Britain, and it is only because the prevalent south-west winds blow over warm surface-water that they are enabled to retain the warmth of southern latitudes and impart some of it to the north-west of Europe. If, on the other hand, there were no prevalence of south-west winds, the warmth of the Atlantic water would be of little avail to raise the temperature of Europe, as we know from the Arctic temperatures that are liable to occur when the air currents come from other directions, even in Ireland, which is practically bathed by the Gulf drift. We

would here remark that the raising of the mean temperature of Europe by the Atlantic ocean, although essentially a winter process, is distinctly apparent in the mean *annual* temperature, despite the decided cooling effect in summer. The reason is that in the colder latitudes of the temperate zone, say above 45° N., the sea is on the balance of the whole year warmer than the land, whereas in the warm latitudes south of the forty-fifth parallel the reverse is the case. Another cause, not, however, of great importance, suggested by Köppen for the higher mean annual temperature in Europe than in corresponding latitudes in Asia, is the fact that in Europe winter is a more cloudy season than summer, the reverse holding in Asia. No doubt this seasonal distribution of cloudiness does tend to have the effect which Köppen indicates, but we would point out that we are here considering what in chemical parlance we should style a reversible reaction. The low winter cloudiness of Asia is to a certain extent a cause of the great cold over that continent, but a balance is struck at a certain stage, and it must, in fact, be regarded as an effect of the cold, the atmosphere being at too low a temperature to hold much vapour. Similarly, the high summer cloudiness in Asia may tend to reduce the temperature, but it is itself actually the physical product of the fierce summer heat over this enormous land mass. In order to elucidate this more clearly, let us compare the conditions of winter cloudiness in the insular climate of Britain, the moderately continental climate of European Russia, and the extreme continental climate of Asiatic Russia, three regions similarly placed as regards latitude. The British islands are very cloudy in winter because the North Atlantic ocean is incessantly throwing off large quantities of water-vapour at a temperature far too high for the cold latitude in which they are placed. Hence condensation results. In European Russia the winter skies, though less wild, ragged, and storm-swept than in Britain, are perhaps even more stubbornly leaden and overcast; but in Russia the condensation is due not to excess of Atlantic vapour, but to the low temperature of Eastern Europe bringing such vapour as the atmosphere does contain below the point of saturation. On passing eastwards into the intense cold of Siberia the process reverses itself, for apart from the thick misty horizons peculiar to all northern countries in winter, there is not much true cloud in Siberia, the winter skies being remarkably clear and bright, and the snowfall scanty in comparison with European Russia. The intense winter cold of Siberia is due partly to the enormous land mass of Asia itself, and partly to the fact that the land is cut off from warm moisture-laden oceanic winds; and so, while a relatively small amount of vapour in the air may tend to increase the cold, the intensity of the latter is here such as to precipitate out of the atmosphere an early snowfall, leaving the winter skies clearer than in the warmer countries further west.

Scientific Exploration of the Adriatic.—We referred last year (vol. 36, p. 99) to the inauguration of a project for the scientific exploration of the Adriatic by organizations formed with Government support both in Austria and in Italy, which, acting in harmony, should carry out systematic researches over a series of years. The programme includes regular cruises at least four times a year, with the object of determining the physical conditions of the open water of the Adriatic at the different seasons. Suitable vessels—the *Najade* and *Ciclope*—have been detailed for the work by the Naval Departments of the two countries, and the first cruises took place early in the present year. The scientific staff of the *Najade* was placed under the orders of Prof. E. Brückner, who summarizes the results of the cruise in the *Mitteilungen* of the Vienna Geographical Society, 1911, No. 4. The object was not only to test the scientific

equipment of the *Najade*, but to obtain data for the determination of the winter conditions of the sea, by observations along eight different cross-sections, four of which were assigned to Austria and four to Italy. Dr. Brückner gives a detailed description of the methods adopted, but it will suffice here to refer briefly to the scientific results. Observations at all the stations on the cross-sections were carried out between February 26 and March 3, so that they may be regarded as practically synchronous. The time chosen proved particularly suitable, as it fell precisely at the moment when the winter conditions of the gulf water reached their maximum—an event which happens somewhat later than the atmospheric maximum is reached, though varying in date from year to year. The following facts were brought out as regards the distribution of temperature. Along the median line the surface temperature rose regularly from north to south, but this is due only in part to the influence of latitude, the low temperatures towards the north being in great measure due to the influx of cold river-water at that end. Lower temperatures were also observed nearer the coasts than in the centre of the gulf, and in both directions the variations of surface salinity followed a parallel course with those of temperature. As regards the vertical distribution of temperature, it was found that a homothermic condition, from the surface to the bottom, had been reached at nearly all the stations. On the other hand, wide differences occurred between neighbouring stations, the minimum at each station being without exception *higher* than the maximum at the next towards the north. That such differences can be maintained, with no tendency to the establishment of equalizing currents, is due to the fact that the similar variations in temperature and salinity act in opposite directions on the density, which is thus practically the same throughout. It has been generally supposed that a movement of warmer and salter water takes place northward along the Dalmatian coast, and one of colder and less saline water southward along the Italian; but of such currents no trace was observed. The whole mass was, at the time of the cruise, virtually in a state of stagnation. The vertical convection currents, from which the equality of temperature and salinity had resulted, had also caused a general aeration, as shown by the high proportion of carbonic acid gas throughout most of the mass. That it was lower in the greatest depths, especially in the Pomo basin, shows, consistently with the unusually low temperature in these, that the convection currents of last winter did not reach these depths.

GENERAL.

An International Aviation Map.—On May 26 and 27 of this year a conference of the International Aviation Map Commission took place in Brussels under the presidency of Prince Roland Bonaparte, representatives from Belgium, Germany, France, Austria, and England being present, and including such distinguished scientists as Baron Alphonse Berget, and Professors Berson and Bamler. In the proceedings of the Conference a distinction was made between questions ripe for discussion and those of a more problematical character; definitely formulated votes being adopted only in the case of the former. They arose for the most part directly out of the discussions of the Conference, while the more theoretical matters were the subject of lectures by specialists. The recommendations adopted had to do with (1) scale; (2) subdivision of the map and boundaries of the several sheets; (3) the numbering and naming of the sheets; (4) the orthography of geographical names. An important decision was reached in the adoption of the scale of 1 : 200,000, while it was also agreed that the separate sheets should each embrace the field of one degree. The

initial meridian to be that of Greenwich, the descriptive text in the language of the nation concerned. A single sheet of the International millionth map would correspond to 25 sheets of the new aviation map, but considerable objection was made to the employment of the former for the purpose of giving a general view of the area in question. As regards the method of representing the surface, the only recommendation that found acceptance (out of some twenty-five different suggestions) was that on the occasion of the next great overland aviation contest, a variety of such systems might with advantage be tested. Exception was taken by the English representative to overloading the map with conventional signs in red; stress was, however, laid on the desirability of a uniform representation of electrical power stations by series of red crosses. The question of the representation of relief was also held to be not yet ripe for decision. On this subject a paper was read by Dr. K. Peucker, one of the Austrian representatives, who insisted on the need of a special method of representation fitted to bring out visibly to the eye the extent of the difference in altitude, so that the aviator might be able to grasp the exact measure of the obstacles to free progression. In accordance with this view, it has been decided by the German Association of Aviators to construct a specimen-map of a portion of the Rhine basin on the colour-plastic system. The recommendations of the Conference, as also the results of experiments in the desired directions, are to be laid before the International Aviation Congress at Rome in October. Special mention should be made of an address by Prof. Berget before a general meeting of the Belgian Aero Club on the subject of topography and aeronautics. The lecturer brought out on the one hand the reasons which lead aeronauts to make a new claim on cartography, and on the other, the extent to which aviation may help to raise cartography to a higher level. He took a hopeful view of the possibilities of photocartography as developed by Captain Scheimpflug, by which, he thought, an accurate survey of a continent such as Africa might be completed in a tenth of the time and a fraction of the cost involved by the methods now in use.*

CORRESPONDENCE.

"Senkungsfeld."

University, Glasgow, August 10, 1911.

An English equivalent seems required for Prof. Suess's useful term "Senkungsfeld." The converse term "Horst" has been adopted in English, and as we have it already in use with the spellings "Hirst," "Hurst," and "Hyrst," the variant may be conveniently accepted. Senkungsfeld is, however, hardly suitable for direct adoption into English, though it is being used by some authors, such as Andrews and Jutson in Australia. The term is too foreign in aspect for a word which should be so frequently used in geographical writings. The term "Senkung," moreover, suggests that the area is still subsiding. Flugel's Dictionary, for example, renders it as "the act or state of sinking." Unless some more suitable equivalent can be suggested, I propose the adoption of "Sunkland."

J. W. Gregory.

* This subject was discussed from a less optimistic standpoint in the review of Captain Scheimpflug's papers on the subject which appeared in the August number (p. 198).

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full :—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Adriatic. *Z. Ges. E. Berlin* (1911): 262–268. **Grund.**

Die italienisch-österreichische Erforschung des Adriatischen Meeres. Die ozeanographische Probefahrt S.M.S. *Najade* (25. 2. bis 7. 3. 1911). Von Prof. Dr. Alfred Grund.

Cf. note at p. 322, *ante*.

Adriatic—Tide. *Ann. Hydrographie* **39** (1911): 118–130. **Defant.**

Ueber die Periodendauer der Eigenschwingungen des Adriatischen Meeres. Von Dr. A. Defant.

Alps, Central—Geology. **Tolwinski.**
Vierteljahrschrift Naturforsch. Ges. Zürich **55** (1910): 331–390.

Die Grauen Hörner. Von Konstantin Tolwinski. *Sketch-map, Sections, and Illustrations.*

Alps, Eastern—Lake. *Internat. Rev. Hydrobiologie, etc.* **3** (1911): 506–542. **Mikoletzki.**

Zur Kenntnis des Faistenauer Hintersees bei Salzburg, mit besonderer Berücksichtigung faunistischer und fischereilicher Verhältnisse. Von Dr. Heinrich Micoletzky. *Sketch-map and Illustrations.*

Alps—Western. **Coolidge.**

Le "Mont Alban." Par W.-A.-B. Coolidge. (Extrait de la *Revue Alpine* de Février, 1911.) Lyon, 1911. Size 9½ × 6, pp. 6.

This name, found on old maps, seems to refer to the Rutor on the Savoy frontier.

Austria—Bohemia. **Engelmann.**

Die Terrassen der Moldau-Elbe zwischen Prag und dem Böhm. Mittelgebirge. Inaugural-Dissertation zur Erlangung der Doktorwürde genehmigt von der Philosophischen Fakultät der Friedrich-Wilhelms-Universität zu Berlin. Von Richard Engelmann. *Sections and Illustrations. Presented by the Author.*

Austria—Dinaric Alps. *Z. Ges. E. Berlin* (1911): 311–320. **Grund and Rühl.**

Grunds Studien im Dinarischem Gebirge. Von Dr. Alfred Rühl.

Discussion of a memoir published in 1910 (see *Journal*, vol. 37, p. 222).

Austria—Karst. *M. k.k. G. Ges. Wien* **54** (1911): 3-47. **Hoffer.**
Unterirdisch entwässerte Gebiete in Innerbosnien. (Ein Beitrag zur Karsthydrographie.) Von Prof. Dr. Max Hoffer. *Sketch-map.*

Austria—Karst. *M.G. Ges. Wien* **54** (1911): 258-273, 274-277. **Waagen and Grund.**
Grundwasser im Karst. Von Dr. Lukas Waagen. Erwiderung von A. Grund.

Central Europe—Glaciation. *M.G. Ges. Wien* **54** (1911): 281-289. **Hassinger.**
Das Südende der eiszeitlichen nordischen Vergletscherung in Mitteleuropa. Von Dr. Hugo Hassinger.

Eastern Europe—Palæogeography. *Ann. de G.* **20** (1911): 233-259. **Cvijić.**
L'ancien lac Egéén. Par J. Cvijić. *Maps, Sections, and Illustrations.*

France—Alpine valleys. **Lallemand.**
Nivellement Général de la France. Notice sur le nivellement des vallées des Alpes, et sur le relevé et la publication des profils en long de cours d'eau. Par Ch. Lallemand. *Map, Illustrations, and Profiles.*
Reference was made to these operations in vol. **37**, p. 93.

France—Alps. **Coolidge.**
Les Grands Sommets des Alpes de la Tarentaise dans l'Histoire. Par W.-A.-B. Coolidge. (Extrait de la *Revue Alpine*, d'Avril 1911.) Lyon, 1911. Size 9½ × 6, pp. 16.

France—Charente. *Ann. de G.* **20** (1911): 213-232. **Passerat.**
Les origines de la vallée de la Charente. Par C. Passerat. *Sketch-maps and Sections.*
See note *ante*, p. 315.

France—Molluscs. *B.I. Océanog. Monaco*, No. 203 (1911): pp. 12. **Guérin-Ganivet.**
Notes préliminaires sur les Gisements de Mollusques comestibles des Côtes de France. La Côte occidentale du Finistère comprise entre le hâvre de Guissény et le goulet de Brest. Par J. Guérin-Ganivet. *Maps.*

France—Seine. *B.S.G. Italiana IV.* **12** (1911): 31-56, 214-257. **Pullè.**
Fenomeni idrologici e climatologici nel bacino della Senna. Del Dr. Giorgio Pullè. *Sketch-map.*

France—Seine et Marne—Dunes. **Duffart and Bergeron.**
B.G. hist. et descriptive, 1910 (1911): 372-379.
Les dunes continentales de Moret-sur-Loing, front oriental de la forêt de Fontainebleau. Par M. Charles Duffart, en collaboration avec M. François Bergeron. *Sketch-map.*

France—Touraine. *B.G. hist. et descriptive*, 1910 (1911): 394-409. **Chauvigné.**
Topographie gallo-romaine de la Touraine. Par M. Auguste Chauvigné. *Sketch-map.*

France—Yeu. *B.G. hist. et descriptive*, 1910 (1911): 380-393. **Pawlowski.**
Les transformations du littoral français. L'île d'Yeu à travers les âges, d'après la géologie, la cartographie et l'histoire. Par M. Auguste Pawlowski.

Germany—Bavaria. *Deutsche Rundschau G.* **33** (1911): 206-312. **Reindl.**
Dörfer, Weiler und Einzelhöfe im Allgäu. Von D. Josef Reindl.

Germany—Bavaria—Geodesy. **Schmidt.**
Sitzb. K. Bayerischen A.W. (München), Math.-phys. Kl., 1910: No. 11, pp. 36.
Koordinatenberechnung und Netzanschlüsse der südbayerischen Dreieckskette. Von M. Schmidt. *Sketch-maps.*

Germany—Harz—Morphology. **Gehne.**
Beiträge zur Morphologie des östlichen Harzes. Von Hans Gehne. Halle a. S., 1911. Size 9 × 5½, pp. 68. *Map.*

Germany—Helgoland. *Deutsche G. Blätter* **34** (1911): 10-16. **Olbers.**
Von Bremen nach Helgoland im Juli 1798. Von Wilhelm Olbers.

Germany—Prussia. *XII. Jber. G. Ges. Greifswald*, 1909-10 (1911): 385-488. **Müller.**
Beiträge zur Siedelungskunde Neu-Vorpommerns und der Insel Rügen. Von Dr. Rich. Erich Müller. *Maps.*

Germany—Prussia. *XII. Jber. G. Ges. Greifswald*, 1909-10 (1911): 73-194. **Seelheim.**
Die Ueckermünder Heide. Ein Beitrag zur pommerschen Landeskunde. Von Dr. Heinr. Seelheim. *Sketch-map, Sections, and Illustrations.*

Germany—Prussia—Coast. **Krüger.**
XII. Jber. G. Ges. Greifswald, 1909–10 (1911): 195–294.
Ueber Sturmfluten an den deutschen Küsten der westlichen Ostsee mit besonderer Berücksichtigung der Sturmflut vom 30./31. Dezember 1904. Von Dr. Gustav Krüger. *Map and Charts.*

Germany—Prussia—Greifswald. **Hahndorf.**
XII. Jber. G. Ges. Greifswald, 1909–10 (1911): 295–384.
Das Klima von Greifswald. Von Dr. Carl Hahndorf. *Diagrams.*

Germany—Rügen. *XII. Jber G. Ges. Greifswald*, 1909–10 (1911): 1–72. **Bebber.**
Die Feuchtigkeitsverhältnisse von Putbus auf Rügen (1854–1903). Ein Beitrag zur Klimatologie der deutschen Ostseeländer. Von Dr. Hans von Bebber. *Map and Diagrams.*

Holland—Anthropology. **Wilde.**
Ts. K. Nederl. Aardr. Genoots. II. Ser. **28** (1911): 414–447.
Onze anthropologische Kennis der Nederlandsche bevolking. Door W. J. de Wilde.

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Vänerns vattenstånd, dess perioder och dess reglerung. Af Axel Wallén. *Illustrations and Diagrams.*

A larger memoir by the same author was noticed in the February number, vol. 37, p. 210.

Sweden—Peat mosses. **Kurck.**
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Annuaire géol. et min. Russie. **12** (1910): 189–207.
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The Highways of England. By George Montagu. *Sketch-maps.*

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The neolithic remains of Colonsay, in the Western Isles of Scotland. By W. B. Wright and the late Angus M. Peach. *Sketch-map and Illustrations.*

United Kingdom—Ireland—Fisheries. **Fisheries Branch, Department of Agriculture.**
Department of Agriculture and Technical Instruction for Ireland. Report on the sea and inland fisheries of Ireland for 1909. Dublin, 1910. Size 9½ × 6, pp. xxxvi. and 124.

United Kingdom—Irish coast. **Hoskyn.**
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The Plant Remains in the Scottish Peat Mosses. Part IV. The Scottish Highlands and Shetland, with an Appendix on the Icelandic Peat Deposits. By Francis J. Lewis. (From the *Transactions of the Royal Society of Edinburgh*, vol. 47, part iv., No. 26). Edinburgh, 1911. Size 12½ × 9½, pp. [793–833]. *Illustrations, Diagrams, and Sections. Presented by the Author.*

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Memoirs of the Geological Survey. England and Wales. The Water Supply of Sussex from underground sources. (Supplement.) By William Whitaker. With contributions by Dr. H. R. Mill and Dr. H. F. Parsons. London: Darling & Son, 1911. Size 9½ × 6, pp. viii. and 125–256. *Maps and Sections. Price 2s. 6d.*

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A Historical Sketch of Cartography in China previous to her modern intercourse with the Occident. By T. Ogawa. *Maps.* [In Japanese.]

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Travaux Sous-Sect. Troïtzkossawsk-Kiakhta, Imp.-Russ. G.S. **11** (1910): 65–74.

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The Geology of the Andaman Islands; with references to the Nicobars. By G. H. Tipper. *Maps, Section, and Illustrations.*

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The Trend of Mineral Development in India. By Prof. Sir Thomas H. Holland.

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The North-West Frontier Province of India. By Dr. W. R. H. Merk. *Sketch-map.*

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Chinese Riddles on Ancient Indian Toponymy. Part I. Ch'a-po-ho-lo and Ka-p'i-li. Part II., Nan-mi-hwa-lo. By Colonel G. E. Gerini.

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Die Volksdichte in der oberen Gangesebene auf Grund des "Census of India, 1901." Inaugural-Dissertation . . . von Paul Böllert. Gottingen, 1911. Size 9½ × 6½, pp. vi. and 70. *Map. Presented by the Author.*

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Alum Shale and Alum Manufacture at and near Kalabagh, Mianwali District, Punjab. By N. D. Daru. *Sketch-maps, Diagram, and Plan.*

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Formosa. Los salvajes y la colonizacion japonesa. Por Fr. J. M. Alvarez. *Ilustrations.*

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Le Transiranien. Par M[arcel] Sauvé. *Sketch-map.*

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Vocabulary of English Words and Sentences translated into six languages or dialects, viz. Zanzibar Swahili (Ki-Unguja), Mombasa Swahili (Ki-Mvita), Lamu Swahili (Ki-Amu), Patta Swahili (Ki-Pate), Siyu Swahili (Ki-Siu), Bajun (Faza) Swahili (Ki-Tikun). By the Hon. A. C. Hollis. [London], N.D. Size 8½ × 6, pp. 24.
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Notes ethnographiques sur les peuples communément appelés Bakuba, ainsi que sur les peuplades apparentées, les Bushongo. Par E. Torday et T. A. Joyce. *Maps and Illustrations.*
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Die Kiwuseegrenze zwischen Deutsch-Ostafrika und Belgisch-Kongo. *Map.*

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The Nile flood of 1910. By J. I. Craig.

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Describes a visit to a locality west of Siwa.

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The Sudan to-day and to-morrow. By Herbert L. Bridgman. (Reprinted from the *Journal of Race Development*, vol. 1, No. 4, April, 1911.) N.P. [1911]. Size 9 × 6, pp. 433–446.

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The battle of Dorote was that in which Colonel Moll was killed.

French Guinea—Railway. *B.S.G. Com. Bordeaux* **34** (1911): 97–102, 125–132. **Arcin.**
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Un document nouveau sur l'Afrique occidentale. Le voyage de La Courbe (1685–1687). Par P. Cultru.

This document proves that explorations attributed by Labat to Brue were really made by La Courbe.

German East Africa. *Mitt. Deuts. Schutzgebieten, Ergänzgsh.* **4** (1911): pp. 133. **Jaeger.**
Das Hochland der Riesenkrater und die umliegenden Hochländer Deutsch-Ostafrikas. Ergebnisse einer amtlichen Forschungsreise ins abflusslose Gebiet des nördlichen Deutsch-Ostafrika 1906/07. Von Dr. Fritz Jaeger. Teil 1. Aufgaben und Verlauf. Die Karte. Ergebnisse der Sammlungen. Ethnographisches. *Maps and Illustrations.*

Dr. Jaeger's researches have been frequently referred to in the *Journal*.

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Reisestudien aus Südwest-Africa. Von Prof. Dr. E. Moritz. *Map.*

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Notes sur l'oued Gheris et ses affluents. Par M. Bernard.

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Notes sur le Haut Ziz. Par M. Oustry.

This stream rises in the Great Atlas.

Nigeria—Mineral Survey. **Dunstan.**
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Le Sahara Soudanais. Par Maurice Zimmermann.

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La question du Tibesti. Par Robert de Caix.

Discussion on the political status of Tibesti, suggested by the reports of Turkish action in that part of the Sahara.

West Africa—Climate. **Krause.**
Nova Acta., Abh. k. Leopoldin. A. Naturforscher **93** (1910): xii. and 193–472.
Beitrag zur Kenntnis des Klimas von Salaga, Togo und der Goldküste. Nach meteorologischen Beobachtungen aus den Jahren 1886 bis 1895. Von Gottlob Adolf Krause.

West Africa—Fishery. *Petermanns M.* **57** (1911): [i.]: 238–240. **Gruvel.**
Der Fischfang der Eingeborenen in den Kolonien Westafrikas. Von Prof. Dr. A. Gruvel.

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The Pan-American Union; peace, friendship, commerce. By John Barrett, Director-General. Washington, D.C., 1911. Size 8½ × 6, pp. 254. *Illustrations. Price* $1. *Presented by the Director, Pan-American Union.*

America—Slavery. *B. American G.S.* **43** (1911): 13–26, 106–118, 170–181. **Emerson.**

Geographic Influences in American Slavery. F. V. Emerson. *Sketch-maps, Diagrams, and Sections.* Also separate copy. Size 9½ × 6, pp. 38. *Presented by the Author.*

Canada—Gaspé Peninsula. **Scott.**

Gaspesia. A short description of the Peninsula of Gaspé, of its resources, its approaching railway development, and of Gaspé as a port of call for the Atlantic Mail Steamers. By J. G. Scott. (From the *Quebec Morning Chronicle*, October 1, 1910.) Size 8½ × 5½, pp. 2.

Canada—Quebec. *B.S.G. Québec* **5** (1911): 24–34. **Rouillard.**

La région Labelle. Par Eug. Rouillard.

Canada—Survey. **[Deville.]**

Department of the Interior. Annual Report of the Topographical Surveys Branch, 1909–1910. Ottawa, 1911. Size 9½ × 6½, pp. v. and 162. *Illustrations. Maps in separate case.*

Canada—Trade. **Grigg.**

Trade of Canada. Report to the Board of Trade on the Trade of the Dominion of Canada for the period from July 1, 1906, to March 31, 1910, by his Majesty's Trade Commissioner for the Dominion of Canada. (Mr. Richard Grigg.) London: Wyman & Sons, 1911. Size 13 × 8½, pp. 88. *Map.*

Mexico—Oaxaca. *B.S. Mexicana G.* **3** (1910): 636–647. **Romero.**

El distrito de Tuxtepec. Sus grandes riquezas naturales y la manera de poder explotarlas. Por José Romero.

Mexico—Puebla. *B.S. Mexicana G.* **3** (1910): 671–695. **Andrade.**

Zacatlán de las Manzanas. Por Vicente de P. Andrade.

Mexico—Southern. *National G. Mag.* **22** (1911): 301–320. **Collins and Doyle.**

Notes on Southern Mexico. By G. N. Collins and C. B. Doyle. *Sketch-map and Illustrations.*

North America—Natural bridges. *Popular Sc. Monthly* **78** (1911): 417–427. **Cleland.**

The Formation of North American Natural Bridges. By Prof. Herdman F. Cleland. *Illustrations and Diagrams.*

United States—Arizona. *T.A. Sc. St. Louis* **19** (1910): 131–150. **Keyes.**

Abundance of Meteorites on the Painted Desert, and its bearing upon the Planetesimal Hypothesis of the Origin of the Earth. By Charles R. Keyes.

United States—California—Languages. **Kroeber.**

Univ. California Publ., American Archæology, etc. **9** (1911): 273–435.

The Languages of the Coast of California, north of San Francisco. By A. L. Kroeber. *Map.*

United States—Commercial—Potash. **Mitchell.**

National G. Mag. **22** (1911): 399–405.

American Potash for America. By Guy Elliott Mitchell. *Illustrations.*

United States—Glaciation. *B. American G.S.* **43** (1911): 161–170. **Holway.**

An Extension of the Known Area of Pleistocene Glaciation to the Coast Ranges of California. By Ruliff S. Holway. *Illustrations.*

United States—Harbours. *P.I. Civil Engineers* **183** (1911): 231–251. **Harts.**

Harbour Improvement on the Pacific Coast of the United States. By William Wright Harts. *Plans.*

United States—Illinois. *J.G.* **9** (1911): 209–214. **Ridgley.**

Geographic Influences in the Development of Illinois. By Douglas C. Ridgley.

United States—Indiana. **Capps and Dole.**

U.S. Geol. Surv., Water-Supply Paper **254** (1910): pp. 280.

The Underground Waters of North Central Indiana. By Stephen R. Capps, with a chapter on the Chemical Character of the Waters by R. B. Dole. *Maps, Illustrations, and Sections.*

United States—Leveling. *U.S. Geol. Surv., B.* **434** (1910): pp. 74. **Marshall.**
Results of Spirit Leveling in Delaware, district of Columbia, Maryland, and Virginia, 1896 to 1909, inclusive. By R. B. Marshall.

United States—Leveling. *U.S. Geol. Surv., B.* **437** (1910): pp. 60. **Marshall.**
Results of Spirit Leveling in Maine, New Hampshire, and Vermont, 1896 to 1909, inclusive. By R. B. Marshall.

United States—Missouri. *C.R. IX^e Congrès Int. G.* **3** (1911): 110–122. **Owen.**
The Missouri river and its future importance to the nations of Europe. By Miss Luella Agnes Owen.

United States—Missouri. *T.A. Sc. St. Louis* **19** (1910): 97–112. **Palmer.**
Flora of the Grand Falls Chert Barrens. By Ernest J. Palmer.

United States—Montana. *B.S.G. Philadelphia* **9** (1911): 10–19. **Mansfield.**
The origin of Cliff Lake, Montana. By George R. Mansfield. *Map and Illustrations.*
See note in the August number, p. 204.

United States—Ohio. **Carney.**
Chapters on the Geography of Ohio. Transportation in Ohio. By Frank Carney. (Reprinted from the *Bulletin* of the Scientific Laboratories of Denison University, vol. 16, December, 1910.) N.P., [1910]. Size 9½ × 6½, pp. 125–135.

United States—Ohio. *J.G.* **9** (1911): 169–174. **Carney.**
Geographic Influences in the Development of Ohio. By Frank Carney.

United States—Ohio. **Carney.**
The Economic Mineral Products of Ohio. By Frank Carney. (Reprinted from the *Bulletin* of the Scientific Laboratories of Denison University, vol. 16, December, 1910.) N.P., [1910]. Size 9½ × 6½, pp. 137–181.

United States—Ohio—Glaciation. **Carney.**
Glaciation in Ohio. By Frank Carney. (Reprinted from the *Bulletin* of the Scientific Laboratories of Denison University, vol. 16, December, 1910.) N.P., [1910]. Size 9½ × 6½, pp. 183–231.

United States—Ohio Valley. *J.G.* **9** (1911): 180–182. **Hoke.**
The Ohio Valley in relation to early Ohio History. By George W. Hoke.

United States—Pennsylvania. **Pennell.**
P.A. Natural Sc. Philadelphia **62** (1910): 541–584.
Flora of the Conowingo Barrens of South-Eastern Pennsylvania. By Francis W. Pennell.

United States—Population. ———
Department of Commerce and Labor. Bureau of the Census. Bulletin 109. Thirteenth Census of the United States, 1910. Population by States and Territories. Washington, 1910. Size 11½ × 9, pp. 8. *Sketch-map.*

United States—Sierra Nevada. **Reid.**
Univ. California Publ., B. Geology **6** (1911): 89–161.
The Geomorphogeny of the Sierra Nevada, north-east of Lake Tahoe. By John A. Reid. *Map, Diagrams, and Illustrations.*

United States—Western. *U.S. Geol. Survey, B.* **435** (1910): pp. 88. **Darton.**
A reconnaissance of parts of North-Western New Mexico and Northern Arizona. By N. H. Darton. *Maps, Sections, and Illustrations.*

CENTRAL AND SOUTH AMERICA.

Andes—Juncal group. *Z. Gletscherkunde* **5** (1911): 298–308. **Reichert.**
Vorläufiger Bericht über die Resultate der Juncal-Expedition in den Anden.
See Monthly Record, July, p. 77. Dr. Reichert's earlier explorations were referred to in vol. **36**, p. 496.

Argentine—Andes. *Alpine J.* **25** (1911): 402–411, 489–495. **Larden.**
Three Weeks' Camping-out in the Andes. By Walter Larden. *Sketch-map and Illustrations.*

Argentine—Agriculture. **Martinez and others.**
Argentine Republic. Agricultural and Pastoral Census of the Nation. Stock-

breeding and Agriculture in 1908. 3 vols. Vol. 1. Stock-breeding; pp. xviii. and 434. Vol. 2. Agriculture; pp. x. and 440. Vol. 3. Monographs; pp. xcvi. and 706. Census taken up . . . by a committee consisting of Mr. Alberto B. Martinez, Dr. Francisco Latzina, Dr. José León Suárez and Emilio Lahitte. Buenos Aires, 1909. Size 10½ × 7. *Maps, Diagrams, and Illustrations. Also maps in separate case.*

Vol. 3 opens with a geographical study by F. Latzina.

Argentine—Buenos Aires. **Varela and Udaondo.**

Plazas y calles de Buenos Aires: significación histórica de sus nombres. Por Adrian Beccar Varela y Enrique Udaondo. 2 vols. Buenos Aires: Size 9 × 6, pp. (vol. 1) xii. and 452, (vol. 2) 502. *Plans. Presented by the Comision Nacional del Centenario.*

Argentine—Geology. **Stappenbeck.**

Umrisse des geologischen Aufbaues der Vorkordillere zwischen den Flüssen Mendoza und Jachal. Von Richard Stappenbeck. (Geologische und Palæontologische Abhandlungen, herausgegeben von E. Kokken; N. F., Band IX., Heft 5.) Jena; G. Fischer, 1911. Size 12 × 9, pp. 144. *Map, Illustrations, and Sections. Price* 30*s.*

Argentine—Historical. **Mabragaña.**

H. Mabragaña. Los mensajes; historia del desenvolvimiento de la Nacion Argentina redacta cronologicamente por sus Gobernantes, 1810–1910. Publicacion autorizada por la Comision Nacional del Centenario. 6 vols. [Buenos Aires, 1910.] Size 11 × 7½. *Presented by the Comision Nacional del Centenario.*

Argentine—Immigration. **Alsina.**

La immigración en el primer siglo de la independencia. Por Juan A. Alsina. Buenos Aires, 1910. Size 10 × 6½, pp. 232. *Diagrams. Presented by the Comision Nacional del Centenario.*

Argentine—Orography. *Petermanns M.* **57** (1911): 293–297. **Stappenbeck.**

Die Vorkordillere zwischen den Flüssen Mendoza und Jachal in Argentinien. Von Dr. Richard Stappenbeck. *Map.*

Bolivia—Climate. **Posnansky.**

Arthur Posnansky. El clima del Altiplano y la extension del lago Titicaca con relación á Tihuanacu en épocas prehistóricas. Por Arthur Posnansky. La Paz, 1911. Size 8½ × 5½, pp. ii. and 30. *Plan, Diagram, and Illustrations.*

Bolivia—Climate. **Posnansky.**

B. Oficina Nacional Estadistica, La Paz **6** (1910): 689–702.

El Clima del Altiplano y la Extension del Lago Titicaca. Con relación á Tihuanacu en épocas prehistóricas. Por Arthur Posnansky. *Section and Illustrations.*

Bolivia—Survey. **Platen.**

Ministro Relaciones Exteriores [*Bolivia*] *Memoria*, 1910 (1911): *Anexos*, 57–63.

Informe sobre trabajos geodésicos y topográficos ejecutados en la región de Puerto Suárez, Sucre (Guachalla), provincia di Chiquitos. Por J. V. Platen.

Bolivia—Tihuanaco. **Arlach.**

B. Oficina Nacional Estadistica, La Paz **6** (1910): 703–751.

Tiahuanacu. Por Tomás O'Connor d'Arlach.

Brazil—Railway. *B. Pan-American Union* **32** (1911): 432–452. **Ashmead.**

The Madeira-Mamoré Railway. By P. H. Ashmead. *Portrait and Illustrations.*

Chile—Surveys. ———

República de Chile. Tercera memoria del director de la Oficina de Mensura de Tierras pasada al Señor Ministro de Colonizacion en Abril de 1910. Santiago, 1910. Size 10½ × 7, pp. 248. *Maps, Diagrams, and Illustrations. Presented by the Oficina de Mensura de Tierras, Chile.*

Deals chiefly with the progress of land settlement and surveys.

Dutch Guiana. *Ts. K. Nederl. Aardr. Genoots.*, Ser. II. **28** (1911): 299–310. **Hulk.**

Brieven over de Corantijn-expeditie. Door J. Fr. Hulk.

See note in the Monthly Record, June.

Ecuador—Galapagos Islands. *P. California A. Sc.*, Ser. IV. **1** (1911): 7–288. **Stewart.**

Expedition of the California Academy of Science to the Galapagos Islands,

1905–1906. II. A Botanical Survey of the Galapagos Islands. By Alban Stewart. *Map and Illustrations.*

Ecuador—Galapagos Islands. *B. Pan-American Union* **32** (1911): 222–239. **Fortescue.**
The Galapagos Islands. By Granville Fortescue. *Sketch-map and Illustrations.*

Panama. *Smithsonian Rep.* 1909 (1910): 607–637. **Bell.**
The Republic of Panama and its people, with special reference to the Indians. By Eleanor Yorke Bell. *Sketch-map and Illustrations.*

South America. *Arkiv för Zoologi* **7** (1911): No. I. pp. 26. **Hägg.**
Interglaziale und postglaziale Meeresmollusken aus Feuerland und Südpatagonien als Beweis für ein wärmeres Klima als das jetzige. Von Richard Hägg.

Tropical America. *B. American G.S.* **43** (1911): 36–45. **Smith.**
The Economic Importance of the Plateaus in Tropic America. By Prof. J. Russell Smith.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Discovery. **Hargrave.**
Lope de Vega. By L. Hargrave. Sydney, 1911. Size 8½ × 5½, pp. 18. *Chart and Illustrations.*

By a series of somewhat random speculations, the writer associates a rock inscription on the east coast of Australia with a supposed visit of Lope de Vega, Mendaña's lieutenant.

Easter Island. **Couteaud.**
Les origines de l'île de Paques. Par Dr. Couteaud. (Extract from *Revue de l'École d'Anthropologie de Paris*, March, 1910), Paris, 1910. Size 10 × 6½, pp. 86–97. *Illustrations.*

New Guinea—Dutch. [Herderschee.]
Ts. K. Nederl. Aardr. Genoots. II. Ser. **28** (1911): 448–461.
De Wetenschappelijke uitkomsten der Mamberamo-expeditie 1909–10. *Map and Illustrations.*

See *Journal*, vol. **36**, p. 497.

New Guinea—Dutch. ———
Ts. K. Nederl. Aardr. Genoots. II. Ser. **28** (1911): 494–504.
De arbeid der exploratie-detachementen op New Guinea.

The work reported on lay in the Triton-bay, Humboldt-bay, and Island river districts. In the last direction an attempt was being made to cross the central range from south to north (see July number, p. 77).

New Zealand. **Marshall.**
New Zealand and Adjacent Islands. By P. Marshall. Heidelberg: Carl Winter, 1911. Size 10½ × 7, pp. 78. *Sketch-maps and Sections.*
[In 'Handbuch der regionalen Geologie,' herausgeg. von Steinmann und Wilckens, 7 Band, I. Abt.]

New Zealand—Franz Josef Glacier. **Bell and others.**
New Zealand Geological Survey Department of Mines. A Geographical Report on the Franz Josef Glacier. By James Mackintosh Bell, with topographical maps and data, by Reginald Palmer Greville, and Botanical notes, by Leonard Cockayne. Wellington, 1910. Size 11 × 8½, pp. 14. *Maps and Illustrations.*

New Zealand—Phytogeography. **Cockayne.**
New Zealand plants and their story. By Dr. L. Cockayne. Wellington, 1910. Size 8½ × 5½, pp. viii. and 190. *Illustrations.*

Queensland. **Danes.**
Physiography of some limestone areas in Queensland. By Dr. J. V. Danes. (From the *Proceedings of the Royal Society of Queensland*, vol. **23**, 1910.) [Brisbane, 1910.] Size 8½ × 5½, pp. 75–83. *Illustrations.*

Queensland—Dividing Range. *Queensland G.J.* **25** (1909–1910): 83–101. **Danes.**
Report on a tour along the Dividing Range (Better Plateau) from Aramac to Pentland. By Dr. J. V. Danes. *Illustrations. Also separate copy, presented by the Author.*

Queensland—Northern. *Queensland G.J.* **25** (1909–1910): 53–74. **Thomson.**
Expedition to the Gulf of Carpentaria. By Dr. J. P. Thomson. *Sketch-map and Illustrations.*
See note in the Monthly Record, August, p. 205.

POLAR REGIONS.

Antarctic—Charcot Expedition. *B.I. Océanog. Monaco*, No. 206 (1911): pp. 18. **Rouch.**
Expédition Antarctique du Docteur Charcot à bord du Pourquoi-Pas? (1908–1910). Principaux Résultats d'Océanographie physique par J. Rouch. *Charts and Diagram.*

Antarctic—Climate. *Met. Z.* **28** (1911): 145–159. **Woeikof.**
Antarktika. Von A. Woeikow.

Antarctic—Palmer Land. *B. American G.S.* **43** (1911): 282–283. **Balch.**
Palmer Land. By Edwin Swift Balch. *Portrait.*

Arctic—North Pole. **Lewin.**
Did Peary reach the Pole? By "an Englishman in the Street" (W. Henry Lewin). London: Simpkin & Co., 1911. Size 7½ × 5, pp. 86. *Price 2s. 6d. Diagrams. Presented by the Author.*
The writer does not appear to possess any special qualifications for discussing the question.

Arctic Ocean—Ice. *Petermanns M.* **57** (1911) [i.]: 241–243. **Isachsen.**
Die Eisverhältnisse an den Küsten Spitzbergens sowie im Ost- und Westeise 1910. Von Rittmeister Gunnar Isachsen.

Greenland—Archæology. *Meddelelser om Grønland* **47** (1911): 283–358. **Clemmensen.**
Kirkeruiner pa Nordbotiden m.m. i Julianehaab Distrikt. Undersøgelsesrejse i Sommeren 1910. Af Mogens Clemmensen. *Map, Plans, and Illustrations.*

MATHEMATICAL GEOGRAPHY.

Area-measurement. *Petermanns M.*, Ergänzgsh. Nr. **170** (1911): pp. 96. **Willers.**
Zur Geschichte der geographischen Flächenmessung seit Einführung des Planimeters. Von Dr. Th. Willers. Gotha: Justus Perthes, 1911. Size 11 × 7½. (Also pp. 1–68 of the same as Inaugural Dissertation, Göttingen. *Presented by the Author.*)

Cartography. *C.R.A. Sc. Paris* **152** (1911): 1439–1446. **Lallemand.**
Sur un projet de Carte internationale et de Repères aéronautiques. Par Ch. Lallemand. *Sketch-map.*

Cartography—Aviation maps. **Peucker.**
Luftschiffahrt und Landkarte. Ein Umblick in der Frage der Luftschifferkarte. Von Dr. Karl Peucker. [Aus dem *Buch der Fluges*, herausgegeben von H. Hoernes. 2 Bde. Vienna: G. Szelinski, 1911.] Size 10½ × 8, pp. 343–362. *Maps.*

Cartography—Relief maps. **Lyons.**
Ministry of Finance, Egypt. Survey Department. Technical lecture, No. 2, 1908–09. The Representation of Relief on Maps. By Captain H. G. Lyons. Cairo, 1909. Size 10½ × 7½, pp. 20. *Maps.*

Geodesy—Congress. **International Geodetic Association.**
Comptes rendus des séances de la Seizième Conférence Générale de l'Association Géodésique Internationale, réunie à Londres et à Cambridge du 21 au 29 Septembre 1909. 2 parts. Berlin: G. Reimer, 1910–1911. Size 11½ × 9, pp. (part 1) 502; (part 2) 370. *Maps, Illustrations, and Diagrams.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology—Petroleum. *Records Geol. Surv. India* **40** (1910): 320–333. **Stuart.**
The Sedimentary Deposition of Oil. By Murray Stuart.

Geophysics. *Science* **33** (1911): 199–208. **Hayford.**
The Relations of Isostasy to Geodesy, Geophysics, and Geology. By Dr. John F. Hayford. *Diagrams.*

Geophysics. *P.R.I.* **19**, 1908 (1911): 92–106. **Love.**
The Figure and Constitution of the Earth. By Prof. A. E. H. Love. *Diagrams.*

Glacial Phenomena. *Z. Ges. E. Berlin* (1911): 253–262. **Ule.**
Glazialer Karree- oder Polygonenboden. Von Prof. Dr. Willi Ule. *Illustration and Diagrams.*
Discusses the occasional net-like arrangement of glacial detritus.

Glaciers. **Hobbs.**
Characteristics of existing glaciers. By William Herbert Hobbs. New York: The Macmillan Co. (London: Macmillan & Co.), 1911. Size 9 × 6, pp. xxiv. and 302. *Sketch-maps and Illustrations. Price* 13*s.* 6*d. net. Presented by the Publishers.*

Ice. *P.R.I.* **19**, 1908 (1911): 243–276. **Buchanan.**
Ice and its Natural History. By John Young Buchanan. *Illustrations and Diagrams.*

Meteorology. *Ann. Hydrographie* **39** (1911): 64–74. **Brennecke.**
Luft- und Wassertemperatur sowie relative Feuchtigkeit und Niederschläge beobachtet auf einer Reise nach der Westküste Südamerikas und zurück von Dr. Harry Meyer. Von Dr. W. Brennecke. *Chart.*

Meteorology—Evaporation. *Sitz. A.W. Wien* **119**, Abt. IIa. (1910): 1399–1423. **Mache.**
Ueber die Verdunstungsgeschwindigkeit des Wassers in Wasserstoff und Luft. Von Heinrich Mache. *Diagram.*

Meteorology—Upper air. **Everdingen.**
Koninklijk Nederlandsch Meteorologisch Instituut, No. 102. Drachenbeobachtungen an Bord I. M^{s} Pantzerschiff "de Ruyter," angestellt vom Marineleutnant A. E. Rambaldo während der Fahrt nacht Ost-Indien und während des Aufenthalts in W.-Indien, Dez. 1908—Juli 1909. Von Dr. E. van Everdingen. Utrecht, 1911. Size 10 × 6½, pp. 36. *Charts, Diagrams, and Illustrations.*

Meteorology—Winds. *Ann. Hydrographie* **39** (1911): 170–177. **Mey.**
Die Passatwinde des Atlantischen Ozeans. Von — Mey. *Diagrams.*

Meteorology—Winds. *Ann. Hydrographie* **39** (1911): 57–63. **Wendling.**
Die äquatorialen Passatgrenzen und der Kalmengürtel des Atlantischen Ozeans zwischen 24° und 31° W. Lg. im Jahre 1907. Von P. Wendling. *Diagrams.*

Oceanography—Black Sea. *B.A. Imp. Sci. St. Petersbourg* (1911): 391–394. **Nasonov.**
Sur les résultats des travaux exécutés dans la Mer Noire à bord du vapeur "Méotide" par S. A. Zernov. Par N. V. Nasonov. [In Russian.]

Oceanography—Pacific. **Schulz.**
Die Strömungen und die Temperaturverhältnisse des Stillen Ozeans nördlich von 40° N-Br., einschliesslich des Bering Meeres. Inaugural-Dissertation zur Erlangung der Doktorwürde der Hohen Philosophischen Fakultät der Georg-August-Universität zu Göttingen, vorgelegt von Bruno Schulz. Göttingen, 1911. Size 10½ × 7½, pp. 39. *Charts. Presented by the Author.*
Also printed in the *Annalen der Hydrographie*, **39** (1911): 177–190, 242–264.

Phytogeography—Arid regions. *Smithsonian Rep.* 1909 (1910): 453–463. **Spalding.**
Present problems in plant ecology. Problems of local distribution in arid regions. By Prof. Volney M. Spalding.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. *Popular Sc. Monthly* **78** (1911): 164–183. **Tower.**
Geographic Influences in the Evolution of Nations. By Prof. Walter S. Tower.

Ethnology—Eskimos. **Hutton.**
A Thesis on the Health and Diseases of the Eskimos. By Samuel King Hutton. Derby: James Harwood, 1909. Size 8½ × 5½, pp. 52.

Historical—Drake. *C.R. IX^{e} Congrès Int. G.* **3** (1911): 402–419. **De Silva and Nuttall.**
The report on a part of Sir Francis Drake's famous voyage of circumnavigation made by his prisoner, the Portuguese pilot Nuño de Silva, to the tribunal of the Inquisition of Mexico, on May 23, 1579. Literal translation from the original Spanish unpublished document, by Mrs. Zelia Nuttall.
This document was lately discovered by Mrs. Nuttall in the Mexican archives.

Historical—Kant's Geography. **Adickes.**

Untersuchungen zu Kants physikalischer Geographie. Von Dr. Erich Adickes. Tübingen: J. C. B. Mohr, 1911. Size 10 × 7, pp. 344. *Price* 10*s.*

Industries. *B.G.S. Philadelphia* **9** (1911): 20-37. **Tower.**

Some factors influencing the location and migration of Industries. By Walter Sheldon Tower.

Medical Geography. *Petermanns M.* **57** (1911) [i]: 225–228. **Dove.**

Medizinische Geographie. Von Prof. Dr. Karl Dove.

Towns. *G. Jber. Österreich* **8** (1910): 1–32. **Hassinger.**

Ueber einige Aufgaben des Geographie der Grossstädte. (Mit besonderer Berücksichtigung Wiens). Von Dr. Hugo Hassinger.

GENERAL.

Geography. *Popular Sc. Monthly* **78** (1911): 405–119, 223–240. **Davis.**

The Disciplinary Value of Geography. By Prof. W. M. Davis.

Geography and Sociology. *C.R. IX^e Congrès Int. G.* **3** (1911): 30–38. **Máday.**

Les rapports de la Sociologie et de la Géographie. Par le Dr. André de Máday.

Regional Geography. *C.R. IX^e Congrès Int. G.* **3** (1911): 59–64. **De la Blache.**

De l'interpretation géographique des paysages. Par le professeur Paul Vidal de la Blache.

Voyage. **Virgin.**

Kongliga Svenska Fregatten Eugenies resa omkring jorden, under befäl af C. A. Virgin, åren 1851–1853. Vetenskapliga iakttagelser . . . utgifna af K. Svenska Vetenskaps Akademien. II. Delen: Zoologi; 2, Arachnider (pp. 36); 3, Annulater (pp. 78). Upsala, etc., 1857–1910. Size 12 × 9½. *Illustrations.*

This work is completed after an interval of thirty-six years.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Balkan Peninsula. **Langhans.**

Der Schauplatz eines zukünftigen turkisch-bulgarischen Konfliktes. Scale 1:1,000,000 or 1 inch to 15·8 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1911, II. Tafel 10. Gotha: Justus Perthes, 1911. *Presented by the Publisher.*

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from July 1 to 31, 1911.

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(*E. Stanford, London Agent.*)

British Isles—Scotland. **Johnston.**

W. & A. K. Johnston's "3 miles to 1 inch" map of Scotland. Sheets 2, 3, 15, 16. Edinburgh and London: W. & A. K. Johnston, Ltd., 1911. *Price, mounted on cloth to fold,* 2*s. each sheet. Presented by the Publishers.*

A continuation of the sheets noticed in the July number of the *Geographical Journal.* The map is now complete. The price of each sheet is 2*s.*, and not 2*s.* 6*d.* as stated in the previous notice.

Germany—Prussia. **Königl.-Sächs. Generalstab.**

Karte des Deutschen Reiches. Königreich Preussen. Herausgegeben von der Abteilung für Landesaufnahme des Königl. Sächs. Generalstabes. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheet 440, Gera. Dresden: G. A. Kaufmann, 1911. *Price* (*Kupferdruckausgabe*) 1.50*m.*, (*Umdruckausgabe*) 0·50*m. each sheet.*

Switzerland. **Abteilung für Landestopographie, Bern.**

Topographische Karte der Schweiz. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: XIII. Interlaken-Stans; XIV. Altdorf-Chur; XV. Davos-Martinsbruck; XXII. Martigny-Aoste. Bern: Abteilung für Landestopographie, 1910.

Four sheets of the well-known Dufour map of Switzerland, revised and corrected to date. Sheet XXII. extends from Mont Blanc to the Matterhorn, while the other three are adjacent to each other, and extend from a few miles beyond Interlaken on the west to the valley of the Inn on the east. Although more than fifty years have elapsed since the originals of some of these sheets were first engraved, and numerous alterations and corrections have been made, they are still superior, as regards quality of workmanship, to many of the maps of mountainous regions produced at the present time. There are, however, no contour-lines, although numerous heights are given in figures.

ASIA.

Ceylon. **Surveyor-General of Ceylon.**

Ceylon. Scale 1 : 760,320 or 1 inch to 12 stat. miles. Colombo: Surveyor-General's Office, 1910.

Malay Peninsula. **Straits Branch, Royal Asiatic Society.**

Map of the Malay Peninsula. Compiled by and published for the Straits Branch of the Asiatic Society. Singapore, 1911. Scale 1 : 506,880 or 1 inch to 8 stat. miles. 6 sheets. London: Edward Stanford, 1911. *Price* £1 1*s.*

This useful map was first published in 1898, since which date it has been from time to time carefully revised and corrected. In its present form it shows, on a sufficiently large scale for most purposes, all that is known of the geographical features of the Malay peninsula at this date, so far as the scale will allow of their being delineated.

Siberia. **Shitkow.**

Die Samojedenhalbinsel (Ja-mal), Westsiberien. Nach den Aufnahmen der Expedition der Kais. Russ. Geogr. Gesellschaft 1908 unter Leitung von B. M. Shitkow. Scale 1 : 1,750,000 or 1 inch to 27·6 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1911, II. Tafel 3. Gotha: Justus Perthes, 1911. *Presented by the Publisher.*

AFRICA.

German East Africa. **Sprigade and Moisel.**

Karte von Deutsch-Ostafrika, bearbeitet von P. Sprigade und M. Moisel. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. Sheet B 5, Kilimandscharo. Berlin: Deitrich Reimer (Ernst Vohsen), 1911.

The relief on this sheet is well shown, the shading of the mountains being most effective.

Somaliland. **Meunier.**

Ministère des Colonies. Service Géographique et des Missions. Carte de la Côte Française des Somalis et Régions Avoisinantes. Dressée par A. Meunier. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. Sheets: 2, Harrar; 3, Addis Abbaba. Paris: Service Géographique des Colonies, and J. Forest, 1909. *Presented by M. le Ministre des Colonies, Paris.*

Two sheets of a three-sheet map now in course of publication, compiled from the routes of explorers and latest available material. Sheet 3 adjoins sheet 2 on the west, and the two together include the region from Berbera on the Somaliland coast to Harrar and Addis-Abbaba. Plans of Jibuti, Harrar, and Addis Abbaba are given as insets.

AMERICA.

Chile. **Griffiths & Co.**

Longitudinal railway of Chile. Southern section. Scale 1 : 1,267,200 or 1 inch to 20 stat. miles. London: Griffiths & Co., [1911].

North America. **Hulbert.**

The Crown Collection of Photographs of American Maps. Selected and edited by Archer Butler Hulbert. Series II. Vols. 1, 2, and 3. Cleveland, Ohio: The Arthur H. Clarke Co., [1911]. *Presented by the Editor.*

These three portfolios form part of an extensive series of photographic facsimiles of maps and plans of considerable historical importance in connection with the early history of the United States and Canada, taken from the originals in the British Museum, the Public Record Office, and other archives in this country. While Mr. Hulbert was in England searching for historical material in connection with his work on 'Historic Highways of America,' and engaged upon cartographical research for the Smithsonian Institution, he came upon a number of early manuscript maps which had never been published and which were for the most part unknown to students. After communicating with well-known authorities in America, he was asked to procure a set of photographs of the most valuable of these, with the result that twenty-five photographic copies were made. These formed the first series, in five volumes, of which the first appeared in 1904, and they are at present nearly all deposited in leading libraries. However, a second series is now in course of publication, and Mr. Hulbert has very generously presented a copy of the maps and plans comprising this, so far as they have been issued, to this Society's collection, with the promise that the remainder shall be forwarded as they are published. The greater part of this series consists of cartographical documents drawn during the latter years of British rule or just about the time of the declaration of American independence. Each portfolio contains from forty to fifty maps and plans, many of which are of towns, forts, rivers, and harbours, having special reference to military operations, together with a complete list and detailed description. Great credit is due to Mr. Hulbert for the pains he has taken in making the selection and the manner in which he has so successfully accomplished the task he set himself, for the reproductions are most satisfactory, and cannot fail to be of historical value and importance.

United States. **U.S. Geological Survey.**

Topographical Atlas of the United States. Scale 1: 9,600 or 6·6 inches to 1 stat. mile, sheet: Leadville special, Colo. Scale 1: 12,000 or 5·3 inches to 1 stat. mile, sheet: Fort Bayard special, N. Mex. Scale 1: 31,680 or 2 inches to 1 stat. mile, sheet: Wheatland, Cal. Scale 1: 62,500 or 1 inch to 0·9 stat. mile, sheets: Antrim, Ohio; Barrett, Minn.; Bath, N.Y.; Butler, Pa.; Clay City, Ind.; Fond du Lac, Wis.; Frisco special, Utah; Herman, Minn.; McComb, Okla.; McConnelsville, Ohio; Neenah, Wis.; Neversink, N.Y.; New Lexington, Ohio; Pikeville special, Tenn.; Quincy, Wash.; Red Rock, Wash.; Sutton special, W.Va.; Winchester, Wash.; Winnebago, Wis. Scale 1: 125,000 or 1 inch to 1·9 stat. miles, sheets: Ellijay, Ga., N.C., Tenn.; Mount Vernon, Wash.; Pullman, Wash., Idaho; San Marcos, Texas; Uncompahgre, Colo. Washington: Department of the Interior, U.S. Geological Survey, 1911. *Presented by the Director of the U.S. Geological Survey.*

GENERAL.

World. **Diercke.**

Diercke Schulatlas für höhere Lehranstalten. 48. neubearbeitete Auflage von Diercke-Gaebler, Schulatlas für höhere Lehranstalten. *Price* 7 *Marks.*—Diercke Schulatlas für höhere Lehranstalten. Kleine Ausgabe. Zwanzigste neubearbeitete Auflage von Diercke, Schulatlas für die mittleren Unterrichtsstufen. *Price* 3 *Marks.*—Lange-Diercke Volksschul-Atlas. Neubearbeitet und herausgegeben von C. Diercke. *Price* 1.50 *Marks.* Brunswick: George Westermann, 1911. *Presented by the Publishers.*

These are three educational atlases specially arranged for geographical instruction in German schools on up-to-date lines. The first is the largest and most complete. There are the usual sheets of astronomical diagrams, projections, methods of showing land relief, etc., at the commencement, then follow maps of the world as a whole, and afterwards maps of oceans, continents, and special countries. The representation of relief by colour tints is a special feature, and the principal maps are accompanied by smaller ones of the same region showing rainfall, geology, population, plans of harbours, cities, and towns, etc. The German Empire and Central Europe are dealt with in a most complete manner. The maps are all clearly printed, but perhaps in some instances too highly coloured.

The two smaller atlases are composed of maps generally similar in style to the larger atlas, from which, in fact, many of their maps have been taken.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, London, from July 3 to 15, 1911. *Presented by the Hydrographer, Admiralty.*

New Charts—No. 1144, Scotland, west coast: Plans in the Hebrides: Vatersay sound and Castle bay, Sound of Berneray, Village bay (*St. Kilda*), 2*s*. 3303, Black sea, Georgia: Batum bay, 2*s*.—**New Editions.**—No. 3683, England, east coast: Approaches to Sheerness, 3*s*. 3367, Channel islands: Island of Jersey, 3*s*. 1233, Black sea: Plans in the Black sea: Constantza (*Kustenjeh*) anchorage (Bender Erekli), 2*s*. 451, West Indies, Jamaica: Plans on the north coast of Jamaica: Falmouth harbour, Annato bay, St. Ann bay, Port Antonio, Ocho Rios bay, 2*s*. 456, West Indies, Jamaica: Port Royal and Kingston harbours (Plans: Port Royal harbour, Ship channel), 3*s*. 2762, Indian Ocean islands: Comoro islands, with the adjacent coasts of Africa and Madagascar (Plans: Moroni anchorage, Assumption island, St. Thomas anchorage), 3*s*.

America—Great Lakes. **U.S. Weather Bureau.**

Meteorological chart of the Great Lakes, August, 1911. Washington: Department of Agriculture, U.S. Weather Bureau, 1911. *Presented by the U.S. Weather Bureau.*

Atlantic, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, July, 1911. Washington: U.S. Hydrographic Office, 1911. *Presented by the U.S. Hydrographic Office.*

Atlantic, North. **U.S. Weather Bureau.**

Meteorological chart of the North Atlantic Ocean, August, 1911. Washington: Department of Agriculture, U.S. Weather Bureau, 1911. *Presented by the U.S. Weather Bureau.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, August, 1911. London: Meteorological Office, 1911. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **Meteorological Office.**

Monthly meteorological charts of the Indian Ocean, August, 1911. London: Meteorological Office, 1911. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **U.S. Hydrographic Office.**

Pilot chart of the Indian Ocean, August, 1911. Washington: U.S. Hydrographic Office, 1911. *Presented by the U.S. Hydrographic Office.*

Indian Ocean. **U.S. Weather Bureau.**

Meteorological chart of the Indian Ocean, August, 1911. Washington: Department of Agriculture, U.S. Weather Bureau, 1911. *Presented by the U.S. Weather Bureau.*

Norway. **Norges Geografiske Opmaaling.**

Kystkarter. Nr. 54, Vega og Mudvær til Bremsteinen og Skærvær; 65, Saltfjorden til Bodö og Landegode; 67, Leines til Grötöy og Steigen; 215, Söndmörefjordene; 216, Rundö til Ona. Christiania: Norges Geografiske Opmaaling, 1911. *Presented by the Norwegian Geographical Institute.*

Pacific, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, August, 1911; Washington: U.S. Hydrographic Office, 1911. *Presented by the U.S. Hydrographic Office.*

Pacific, North. **U.S. Weather Bureau.**

Meteorological chart of the North Pacific Ocean, August, 1911; Washington: Department of Agriculture, U.S. Weather Bureau, 1911. *Presented by the U.S. Weather Bureau.*

PHOTOGRAPHS.

Arabia. **Lewa Ibrahim.**

Four reproductions of photographs of Mecca and Medina taken by Lewa Ibrahim Pasha Rifaat, 1909. *Presented by Robert Renwick, Esq.*

Apart from these there are only two other sets of photographs in the Society's collection which show these Mohammedan holy places, hence their importance,

which is increased by the fact that they were not taken from the same spots as the others.

(1) The Kaaba, Mecca; (2) The Kaaba and holy mountain, Mecca; (3) The tomb of the Prophet at Medina; (4) View of Medina.

Dutch East Indies and Burma. **Garrett.**

Sixty-nine photographs of the Dutch East Indies and Burma, taken by T. R. H. Garrett, Esq., M.A. *Presented by T. R. H. Garrett, Esq., M.A.*

The native types shown in these photographs are well taken and of special interest.

Dutch East Indies.—(1–37) Banjerese; (38–41) Bugis; (42) Banjerese and Sundanese; (43–50) Orang Balik Papan; (51–56) Sundanese; (57–60) Javanese; (61–64) Batavian Malay. **Burma.**—(65 and 66) The mud volcanoes of Minbu; (67–69) Oil wells at Yeangyaung.

Geographical Pictures. **L'Estrange.**

Philips' Geographical Pictures. A series of twenty plates, enlarged from actual photographs direct from nature, illustrating geographical features. Edited by P. H. L'Estrange, B.A. Series II. British Isles. London: George Philip & Son, Ltd., [1911]. *Price* 21*s. the set. Presented by the Publishers.*

A continuation of the series of geographical pictures which was specially noticed in the *Geographical Journal* for June, 1909. Mr. P. H. L'Estrange, of Malvern College, has done much to promote improved methods of geographical teaching in schools, and this is one of his most important attempts. It is one that should certainly stimulate interest in the subject, and assist in bringing geographical facts before the scholar. Perhaps no two geographical teachers would agree exactly in the selection of subjects for such pictures, but on the whole Mr. L'Estrange has done well in this respect. The pictures, which are in black and white, are excellent enlarged reproductions of photographs, and under each is a brief descriptive note.

Guatemala. **Swayne.**

Fourteen photographs of Maya Indian Ruins at Quirigua, Guatemala, taken by Miss Frances L. Swayne. *Presented by Miss Frances L. Swayne.*

A set of "Kodak" photographs of some ancient Guatemala ruins which have recently been rediscovered, and cleared in the thick forest by the United Fruit Co. The ruins appear to be large monoliths covered with carvings similar in general appearance to those already well known to archæologists. Miss Swayne is a relative of Major-General Sir Eric Swayne, the late Commissioner of Somaliland, now Governor of British Honduras, and it was during a visit to him last April that these photographs were taken. Although small, they are specially important from the fact that they are probably the first ever taken of these ruins.

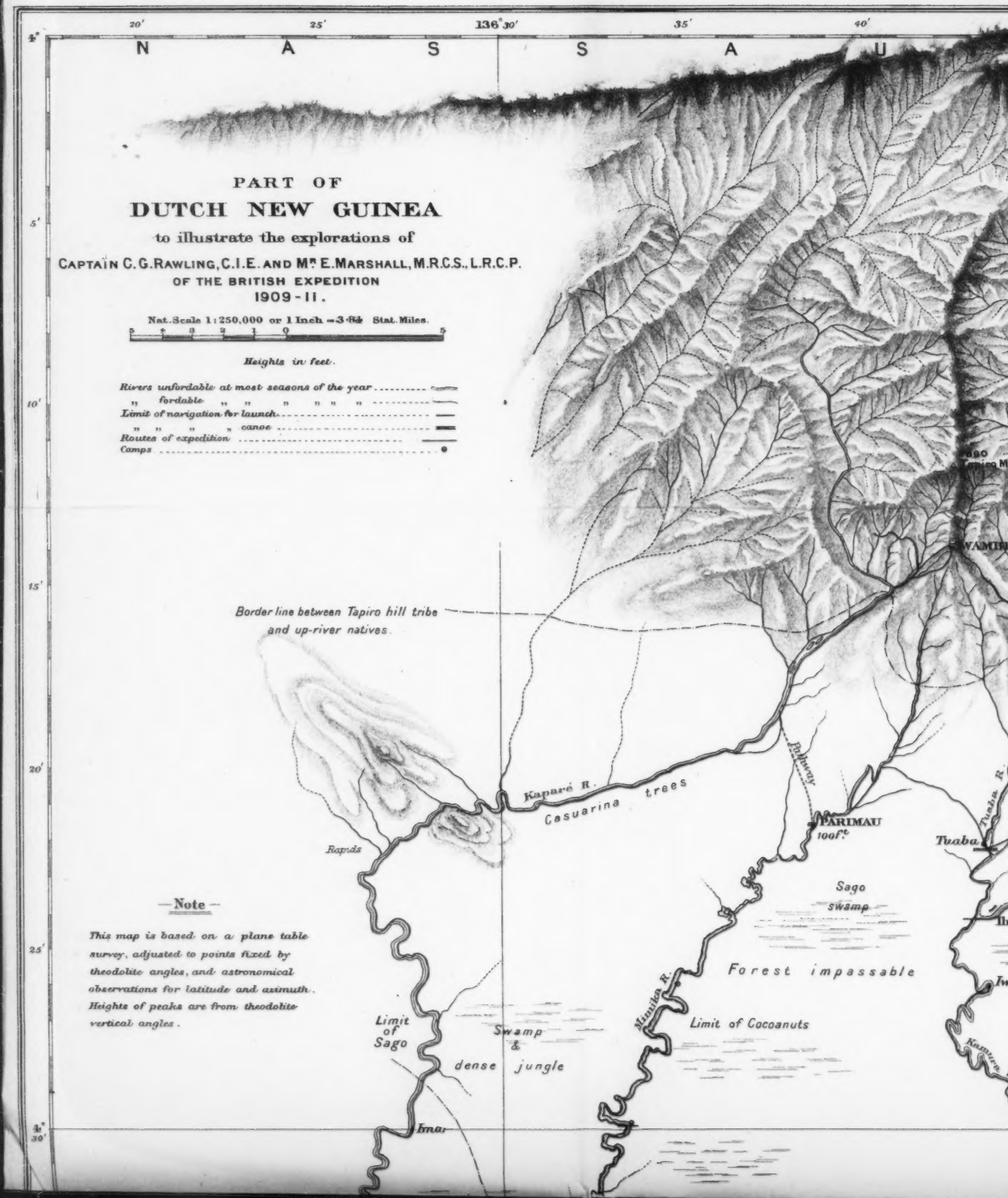
United States. **Snyder.**

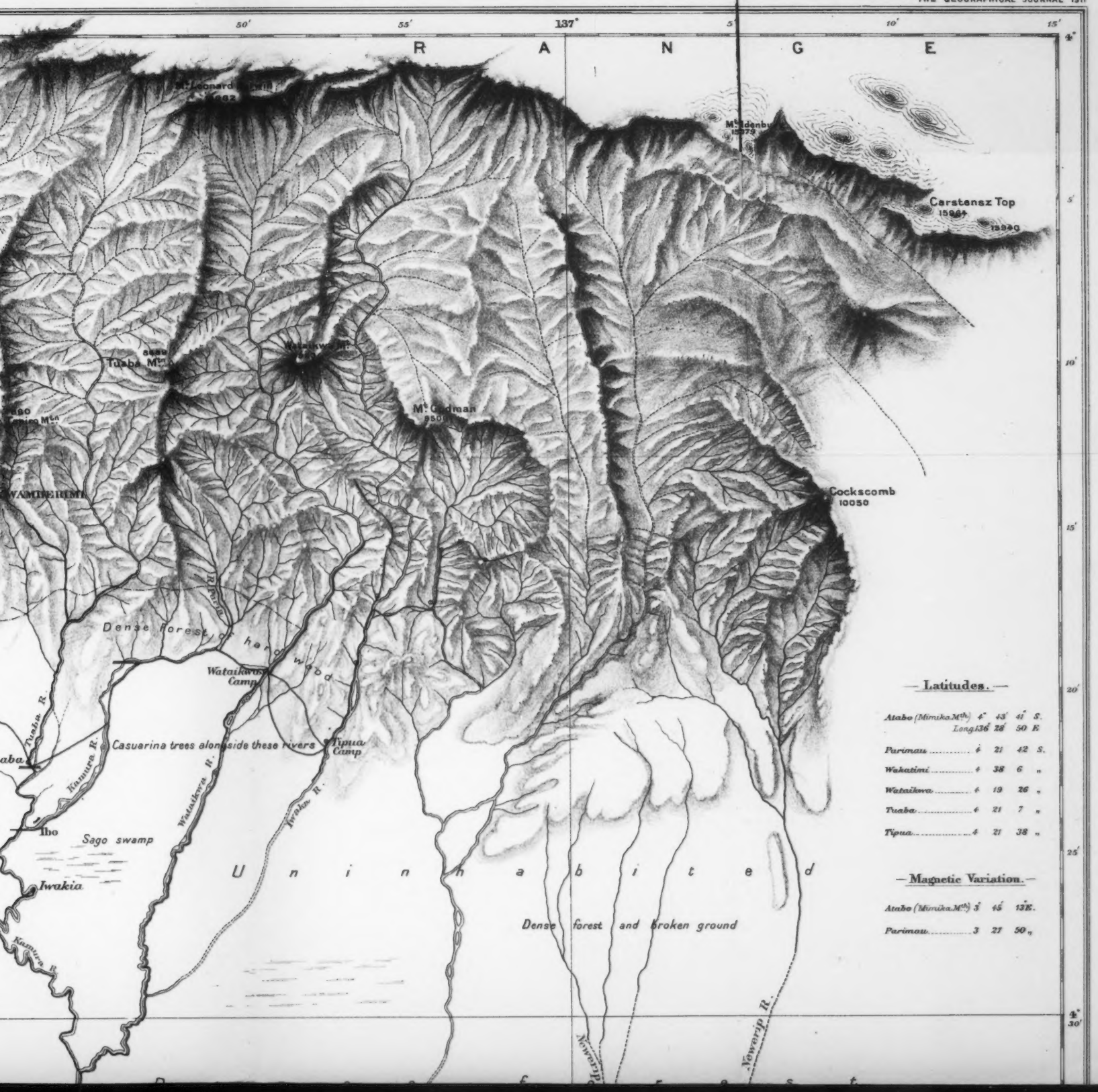
Twenty photographs of North American Indians, taken by Dr. F. D. Snyder. *Presented by Dr. F. D. Snyder.*

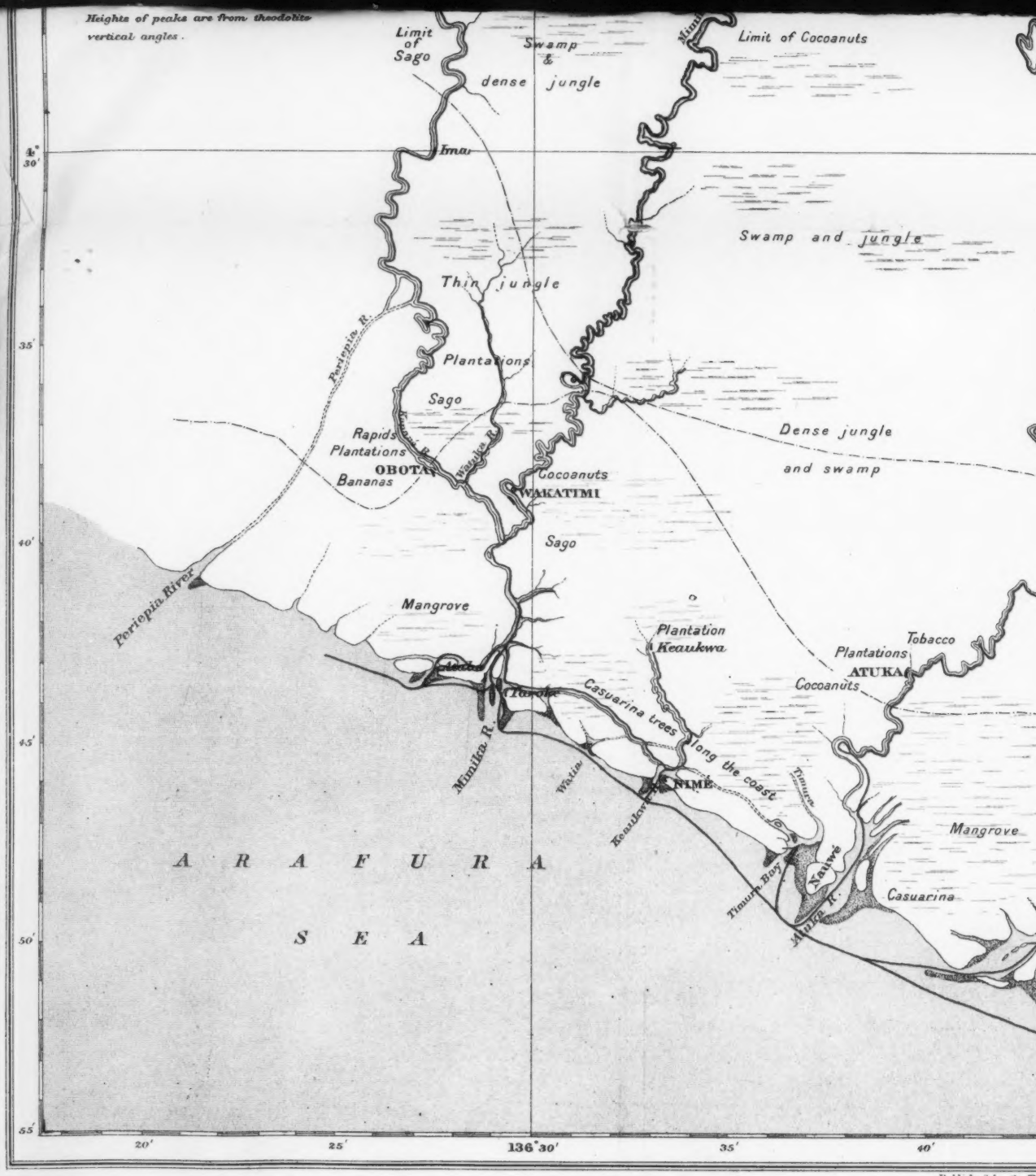
An important feature of these photographs is that they represent the Indians and Indian mode of life as they were years ago before they had been influenced by civilization. Dr. Snyder has been at great trouble and expense to bring the set together.

(1) Crow Indian camp; (2 and 4) Crow Indian girl; (3) Crow medicine man; (5) Crow Indian; (6) Black-hair Crow; (7) Plain Owl Crow; (8) Two-Leggens, chief of the River Crows; (9 and 10) Sioux Indians; (11) Apache squaw weaving; (12) Zuni Indians drilling in stone; (13) Pueblo of Zuni; (14) Indian village; (15) Indian papoose; (16) Indian tepee; (17) Indian baby and cradle on back of mother; (18) North-Western Indian reservation, squaw and tepee; (19) Indian children; (20) Squaw and papoose.

N.B. It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


20'
25'
136°30'
35'
40'
4°
5'
10'
15'
20'
25'
4°30'
N A S S A U
PART OF
DUTCH NEW GUINEA
to illustrate the explorations of
CAPTAIN C. G. RAWLING, C.I.E. AND Mr E. MARSHALL, M.R.C.S., L.R.C.P.
OF THE BRITISH EXPEDITION
1909-11.
Nat. Scale 1:250,000 or 1 Inch = 3·84 Stat. Miles.
5 4 3 2 1 0 5
Heights in feet.
Rivers unfordable at most seasons of the year
" fordable " " " " " "
Limit of navigation for launch
" " " " canoe
Routes of expedition
Camps
Border line between Tapiro hill tribe and up-river natives.
Kaparé R.
Casuarina trees
Railway
PARIMAU
100ft.
Tuaba R.
Tuaba
Rapids
Sago swamp
Forest impassable
Mimika R.
Limit of Cocoanuts
Limit of Sago
Swamp & dense jungle
Iwa
Kamura
Note
This map is based on a plane table survey, adjusted to points fixed by theodolite angles, and astronomical observations for latitude and azimuth. Heights of peaks are from theodolite vertical angles.


50'
55'
137°
5'
10'
15'
4°
R A N G E
Carstensz Top
15984
13240
Cockscomb
10050
Mt. Goodman
9501
Tuaba Mtn.
Wataikwa Mt.
Dense forest and broken ground
Wataikwa Camp
Tipua Camp
Casuarina trees alongside these rivers
Sago swamp
Ibo
Iwakia
Tuaba R.
Kamura R.
Wataikwa R.
Irakia R.
Newaryip R.
U n i n h a b i t e d
Latitudes.
Atabe (Mimika M.Sh) 4° 43' 41" S.
Long 136° 28' 50" E
Parimau ... 4 21 42 S.
Wakatimi ... 4 38 6 „
Wataikwa ... 4 19 26 „
Tuaba ... 4 21 7 „
Tipua ... 4 21 38 „
Magnetic Variation.
Atabe (Mimika M.Sh) 3 45 13E.
Parimau ... 3 27 50 „
4° 30'



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DUTCH NEW GUINEA

RAWLING and MARSHALL